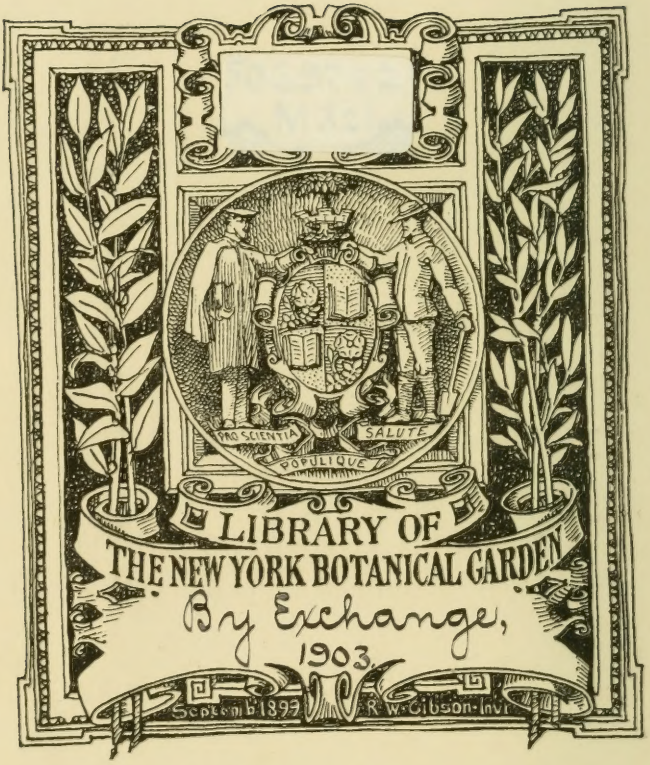
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NATURE STUDY.

PUBLISHED UNDER THE AUSPICES OF THE

Manchester Institute of Arts and Sciences.

VOLUME III. 1902-1903.

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NEW YORK
BOTANICAL
GARDEN

Editor, EDWARD J. BURNHAM.

Associate Editors,
FREDERICK W. BATCHELDER, WILLIAM H. HUSE,
SUSY C. FOGG, THEODORA RICHARDSON.

MANCHESTER, N. H.

1903

XN
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v. 3
1902-03

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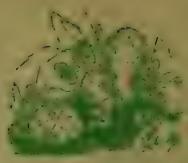
Nature Study...

Vol. III JUNE No. 1

MANCHESTER, N. H.
NATURE STUDY PRESS
...1902...



NATURE STUDY.

A monthly magazine, published under the auspices of the Manchester Institute of Arts and Sciences. EDITOR: Edward J. Burnham. ASSOCIATE EDITORS: Frederick W. Batcheldor, William H. Huse, Susy C. Fogg, Theodora Richardson.

Devoted to the encouragement of the study of Nature in her varied aspects—of the Rocks, the Birds, the Flowers, and all the multitude of living things that crawl or swim, or walk or fly.

Terms: 50 Cents per Annum in Advance.

Advertisements, not to encroach upon reading matter, will be published at a uniform rate of 25 cents an inch for each insertion, without reference to number of insertions or amount of space taken; but no advertisement can be accepted for less than the price of a single inch, one insertion.

Subscribers may insert free, under the head of "Wanted," or "Exchange," any request for information relative to publications desired, minerals or other specimens wanted or for exchange.

Address all matter, whether communications or inquiries, to

NATURE STUDY PRESS, Manchester, N. H.

Entered as Second-Class matter at the Post Office at Manchester, N. H.

YELLOW LADY SLIPPER.

Photographed for Nature Study by E. H. Fogg.

NATURE STUDY.

PUBLISHED UNDER THE AUSPICES OF THE

Manchester Institute of Arts and Sciences.

VOL. III. June, 1902. No. 1.

An Aristocratic Family. I.

BY FREDERICK W. BATCHELDER.

The family is so very aristocratic and so very old that it might be expected to be small in numbers. Such, however, is not the case. It is one of the largest of all the families in the plant world. There are no less than 5000 species already known. The little cold corner of the earth which goes by the name of New England can claim one per cent of these, or just about fifty species. Some of these are so small and their flowers so inconspicuous as to be little known, except to botanists. Others are among the most beautiful of our wild plants.

About the last of April I begin to look for our first local orchid. It is one of the little ones, but none the less interesting that it is small. It thrusts itself up through the sodden leaves in rich woods where little brooks play hide and seek with the mossy rocks and the sunshine. The stem, or more correctly, scape, is from three to eight inches high, naked except for a few sheathing scale-like bracts, and bears at the top a raceme of very small flowers on short pedicels. The color of the whole plant is at first

yellowish green, changing as the flowers mature to a more or less bright yellow. The flowers are of the same tint, except that the part called the lip is pure, unspotted white. This is the early coral-root (*Corallorhiza innata*). In dry seasons it blossoms as early as the first of May. In wet seasons, when the habitat is flooded with running or standing water, the development of the flowers is delayed, and they may not open before the last of the month. This year the flowers first opened on the 11th.

When I have found this coral-root I consider the orchid season fairly begun, and start out to hunt the lady-slippers, which come next in order of time. New England is specially favored by this remarkable and charming genus of the orchid family, for there grow within her limits all but one of the species credited to the northeastern quarter of the United States. Only the small white lady-slipper (*Cypripedium candidum*) is wanting, and this, being a resident of the Middle States, may almost be expected on our southwestern border. We certainly have the other five, the stemless (*C. acaule*), commonly called the pink lady-slipper, the showy (*C. spectabile*), the smaller yellow (*C. parviflorum*), the greater yellow (*C. pubescens*), and the curious ram's head (*C. arietinum*). The ram's head lady-slipper is a northern plant and is rather rare in New England, being mostly confined to the mountain districts. I have found it only in Laconia, N. H., and there but once.

The showy lady-slipper is common enough in Vermont, but is rare east of the Connecticut valley. I have seen it in its native habitat but once, and it is so scarce in that particular place that nothing could induce me to advertise the locality. The pink lady-slipper is so common that there need be no penalty attached to the disclosure of its hiding place. The species frequently produces albinos, or pure white individual flowers, and there is one locality in Manchester where such are found almost every year. But

they should not be confounded with the real white or showy lady-slipper, which is entirely different. The smaller yellow lady-slipper appears to be very rare in this vicinity. I have collected it only in Springfield, Mass., and have received plants from Vermont. The greater yellow lady-slipper, while rare enough, is yet abundant in certain localities not always easy to find and not always made known by the finders.

On the 21st of May, in company with a friend who is an expert photographer, I succeeded in re-finding a station of these plants in a wood where several years since, with another friend, I got completely turned around and lost. This time fortune favored us, and we managed to keep our bearings and eventually come out of the tangle within a mile or so of our calculations. And after long and careful search we found our plants in flower.

The plants of this species grow in leaf-mold in rich woods, especially in spots where there is an underlying stratum of small stones or gravel. Plants not in flower so closely resemble young plants of black hellebore (*Veratrum viride*) that it takes a practiced eye to distinguish them; when in flower there is no mistaking them for anything else. For some reason the plants I have found this season are unusually small, and the flowers also are not up to the average in size. Some of them, in fact, are so small that it is hard to believe they are not of the other species (*C. parviflorum*), the smaller yellow lady-slipper. Examination and comparison tend to prove that in everything except size all the flowers are typical C. pubescens. So I cannot yet claim the other species as a resident, much as I might like to.

In view of this variation in the size of the flowers in the species under consideration, an experience we have had with the plants in cultivation may be interesting. Some years since a wild bed in our garden was supplied with a

number of plants of both the large and the small flowered species. For several seasons these flourished and even increased in number. After a while the flowers of *pubescens* began to grow smaller, until in size some of them barely surpassed those of *parviflorum*. We noted that the latter underwent no change and speculated as to the cause of the change in the former, attributing it to deterioration consequent upon removal to an unnatural habitat. Now that the same variation has been observed to take place among plants growing in their native homes, that hypothesis must be abandoned and the variation must be considered as occurring in the regular course of nature.

There is nothing in the shape of the flower called the pink lady-slipper to suggest the name. The showy part of the flower is a pouch with a closed but easily opened fissure down the whole length in front. In the yellow species the corresponding part is really shaped like a slipper, or rather a baby's sock. In France the flowers are called "les sabots de la Vierge." The large opening in the top has its "raison d'etre," as we shall see when we come to consider the parts of the flower and their uses. A similar construction of the slipper is found in *C. spectabile*, while in *C. arietinum* the extremity or toe is so pointed as to have suggested the common name, ram's head.

The flowers in the orchid family have undergone such extreme modification that it is by no means easy to make out the different parts and compare them with the corresponding parts of an ordinary flower. Yet there is a single type underlying the whole, and the family is doubtless derived from ancestors who possessed regular flowers. With all the enormous difference between the large and small, the showy and the plain, the tropical and the non-tropical, the flowers throughout the family are formed on the same plan. There are always three sepals, even where, as in

Cypripedium, there sometimes appear to be but two. There are always three petals, though one of these has been so changed as to bear no resemblance to ordinary petals, and the other two often take on most singular and unpetal-like shapes. As to the other organs, the stamens and pistils, we shall have to trust to specialists for assurance that they are all there, or at least that there are traces of them. One of the finest pieces of work Darwin did was to study out and demonstrate the ultimate structure of orchids. His labors proved what had been suspected by shrewd botanists before, that there are present in the orchid clear proofs of its descent from ancestors with regular flowers, and that these flowers had fifteen parts in five circles or whorls of three parts each, viz.: three sepals, three petals, three outer stamens, three inner stamens and three pistils. The three sepals only remain with comparatively little change. Two of the petals remain in such a form as to be recognizable, while the third has been developed into what is called the "lip," usually the most conspicuous part of the flower. It is this lip which constitutes the pouch or slipper in Cypripedium. Of the six stamens there remain in Cypripedium two, in all other genera one; but they bear no resemblance to ordinary stamens, the anthers alone being visible, and even they having undergone very singular modification. The three pistils have coalesced into one, the only outward indication of their three-fold character being the presence in some genera of a slightly three-lobed stigma.

All these wonderful changes have been accomplished in the course of long ages by what is known as natural selection, and every one of them was brought about for a purpose, and that purpose was to effect cross-fertilization *by ensuring the removal of the pollen of one flower to the stigma of any flower but itself*. This brings in the agency of insects and the way in which this aristocratic family of

plants has persuaded the insect tribes to assist in the perpetuation of its order.

The Day We Went a Maying.

BY MARY HAZEN ARNOLD.

On the twelfth of May, a beautiful bright morning, when the trees were glorious in a misty sheen of tender green, three bird cranks went forth on a voyage of discovery, and never explorer experienced greater delight at the call of "Land, Ho!" than thrilled this trio at each new discovery in Bird Land.

We had but crossed the threshold ere we were greeted with a welcome of bluebirds, orioles, grossbeaks, meadow larks, the incessant call of chebec, the varied songs of catbird and brown thrasher, the familiar "Cheerily, cheerily," of the robin and the harsh "caw" of the crow. The song sparrow said, "Maids, maids, put on the teakettle!" and the chewink called to us, "Drink your tea!" On a sapling near by sat a cowbird, stupidly gazing at us, as if wondering what sort of specimens these were, anyhow.

Soon we passed the round doorway of a flicker, who beat unceasingly the hollow tree drum to charm his mate. A Veery, with tawny back, crossed the road before us; the ovenbird, evidently thinking school was out, called, "Teacher, *teacher*, TEACHER!" and Bob White warned us that there would be "more wet."

When our destination was reached, we sat down by the wooded banks of a stream and watched a spotted sandpiper getting its breakfast. Repardless of wet feet, he waded boldly into the water and evidently devoured with great relish the rare morsels which he fished therefrom with his long bill. A flash of scarlet and black in the trees above called our attention to the brilliant scarlet tanager. Then

Phœbe called and told us her name, as did also the j-a-y from the woods across the brook.

The red-eyed vireo inquired between mouthfuls, "Here I am. See me? See me?" Buzz, buzz, here flashed a dainty hummingbird. Black and white warblers and redstarts galore came fearlessly about us. A wood thrush hopped demurely through the undergrowth out into the road, where she stopped to deliberately pick up some choice bits left (shall I admit it?) by a passing garbage cart.

Into the road also ventured a half-dozen white-throated sparrows with their pretty striped heads, and the Maryland yellow-throats peered out through black masks from the thickets. Following a harsh "Kuk-kuk" down the stream, we came upon a black-billed cuckoo sitting motionless in a tree.

There were restless gay warblers—enough to turn the steadiest head—the summer yellowbird (like a bit of condensed sunshine), the magnolia warbler in green and gold, the brilliant blackburnian and golden-winged warblers. Flocks of goldfinches filled the treetops with golden splendor, or festooned the air with "per-chick-oree"; then there was a little fellow in golden array, wearing a jaunty black velvet cap, who bore the name of Wilson; a dainty blue-winged warbler caught many an insect napping; the "zee-zee-zee" of the prairie warbler came from the trees above, and the pine warbler led us a merry chase ere we discovered his identity.

Our old acquaintance, the chickadee, was there too, and a chestnut-sided warbler filled its tiny bill with bits of the soft white webbing of the tent caterpillar, to line the new cradle she had nearly completed. The climax was reached when a ruby-crowned kinglet—whose acquaintance we had long desired—peeped out from a tree by the roadside. Do you wonder that not minutes, but hours, slipped quickly

away with such a galaxy of beauty and such melody about us?

As we turned our faces homeward, we "counted our mercies" and found we had been greeted by no fewer than *forty-five* feathered sprites, which included thirteen of the elusive warblers. We decided that this should be marked as a red-letter day in our calendar—a day filled with pleasures, which may be equalled, but we believe seldom surpassed.

Waterbury, Conn.

Seven Men and a Duck.

BY ELIZABETH POLHEMUS.

As I was rowing on Silver Lake at the close of a brilliant October day last fall, I saw bobbing up and down what I supposed was a brown leaf. Suddenly it rose in the water, showing a white breast; then down it dived. A duck, I thought, and with all speed rowed to the spot where it vanished, only to be greeted by a loud burst of laughter from a group of children, who, pointing to the other side of the lake, said: "Look, lady, it's way over there."

A boy, larger than the others, said: "It's lots of fun to watch her. She is a prize diver, and as for swift swimming under water, electricity can't beat her." One of the smallest girls pointed out the quiet nook where she slept at night, resting the delicate, swift feet, and told me that for several weeks they had been watching this strange newcomer. I suppose that being hurt or sick when the flock to which she belonged flew over, she had been left behind, and had never had the courage to try and catch up; for I have read that they fly one hundred miles an hour. As I

never had the privilege of flying with them, I cannot say this is true from my own observation.

While the children were talking, the duck rose again, close beside the boat, that had been quietly floating, and a man who was fishing near by said, "Don't I wish I had my gun? I'd soon spin that little brown head off." He was a prosperous-looking gentleman, weighing about two hundred pounds, with a most humane countenance, giving no indication of his awful thirst for blood, or desire to take life just for sport. A cloud had come over the peaceful picture of the green-fringed lake, reflecting in its clear depths the red and gold of a glorious sunset. I moored my boat and left, thankful that the children had not heard the cruel words.

A few days later I was startled by the sharp report of a shot gun, a most unusual sound, at once my thoughts flew to mad dogs, cats in fits, even to suicide, these thoughts were quickly put to flight by my young son rushing in with quivering lips and eyes blazing with indignation, to say that "Seven men were bombarding that one poor little duck, two at each end, one on each side of the lake, and one rowing after it in a boat with a gun." Stopping to take breath he went on to say, with hands clinched tight, and choking voice, "It is no fair, it is not fair, so many strong men, with guns to help, against a tiny, helpless thing, nothing, no one, to defend her. Big cowards! Why don't they take something their own size? We boys wanted to stone them, or plug sticks at them The cop saw us, and said we 'mustn't.' I suppose that would be rude, and might hurt them. They will kill our little duck; I know they will. She is game, and will do her best, but she hasn't any show."

Down went his head, and then came a great convulsive sob, followed by a hot torrent of tears that relieved for the time being the hurt, sorrowful heart.

This bombarding went on until the seventh day, when the fatal shot was fired, the water was stained with blood, the happy, innocent life that had harmed no one, but given so much pleasure to the village children, was taken. Going down town, I met two processions. First, the gunners, a grand company, walking two by two, proudly keeping step, with heads erect—the very port of heroism—with no look of ferocity on their faces. How little you can tell by a man's looks what is in his heart—"that murder lurks within." Had not their noble spirits led them to endure hardships for seven days—sitting on the hard, damp ground in cramped positions, bugs and flies attacking them from all sides, eating cold lunches, foregoing golf? What will a man not endure or go without when this desire to kill something comes over him? One among them there was who walked with a prouder step and held his head higher than his other comrades, for on his shoulder lay a small dead duck.

Closely following this procession was another, of sad-faced children, mourning their friend. Can these children, growing up under the influence of our humane societies, our nature classes and hosts of nature books, making them know and love everything that grows—can they, as their fathers before them, love to kill just for sport? Time alone can tell.

Newton Center, Mass.

Gulls and Terns of New England. IV.

BY W. R. VARICK, M. D.

Old gulls are wise birds and keep at long range, unless sure of their reception. Young ones may often be lured to their destruction by a man lying behind a sand dune and waving a pair of gull's wings. The unsophisticated youngsters are curious, and come to see what is happening. They often remain. But their parents never are to be caught in any such unseemly manner. The last part played by gulls is that of sentinel. The flocks of ducks that feed along the coast, and in the harbors, have no fear of harm as long as gulls are flying overhead; they see man from afar, and never fail to give good warning of his approach.

There are several striking differences noticeable in the habits of gulls and terns. The tern habitually carries his bill pointed directly downward in flight, a very unusual attitude in birds. The gull carries his forward in the plane of his body, so the tern can always be spotted at sight, if this point is remembered. Terns are expert divers, boldly darting beneath the surface after the fish, but they do not remain long on the water, for, whether successful or not, they immediately take to the wing again, giving themselves a vigorous shake after flying a few yards. They rest on sand spits, spiles, rocks, or floating articles, such as buoys. Swimming and floating are not in their line. Gulls, on the other hand, very rarely dive for food, but pick it from the surface, though they swim splendidly, and are perfectly at home on the top of the water, as their maritime habits would necessitate. Terns are birds of the shore, and do not habitually venture many miles to sea, except in migration.

Again, in flight one notices a difference between the two sub-families. Gulls, the larger species at any rate, are capable of soaring like hawks, and often may be seen mount-

ing into the air in spirals till they seem only white dots, or following a steamer for hours with no apparent wing motion. A Tern never soars; his wing beats are continuous, though not hurried, and give one the impression of great power and endurance. They fly along the shore in pairs or in straggling flocks, sometimes close to the water, often at a good height. A bird sees something suspicious and poises, fluttering just like a kingfisher, then darts like a shot. A foot from the water, perhaps, wings and tail are spread, and the bird shoots upward again without wetting a toe. Next time there no mistake, and our tern dives like an osprey, making the water fly, and emerges in an instant with a little, silvery fish crossways in its bill. It must be admitted that the gulls are of more service to man. The terns of our coast are supposed to confine their diet chiefly to fish, though insects are by no means despised when attainable. They are more dainty in appetite, as well as in form, than their cousins, the famous scavengers.

Terns are always connected in my mind with the old fish weirs that line the harbors and shores along Vineyard Sound. A row of spiles extends a hundred yards out from the beach, supporting a net that guides the fish to the trap that is held in place by a forest of stakes. This for the terns, is as much a place for recreation as for business. They sit on the stakes, always facing the wind, watching for the small fish, occasionally darting at a neighbor and pushing him off his perch, a feat that is apt to start a dozen of them into a wild lark in mid-air, chasing, dodging, and keeping up a terrific clatter of harsh cries.

One may sometimes see a weir covered with white birds, not only the posts, but the connecting ropes being lined with as many as can find a foothold, while others circle about looking for room. Another weir, close by, may not have a visitor. The terns render fishermen a real service. They are always the first to discover the schools of fish that

come to the surface, and act as unfailing guides to the slow moving fishing boats. On the blue fish grounds, a dozen catboats may often be seen sailing idly about, as if having no particular business there. The occupants are on the watch, not for fish, but for terns. One is seen in the distance hovering for an instant, then diving. Another bird sees him and almost at once a flock has gathered, darting and screeching, picking the minnows from the surface, as the blue fish drive them from below. By this time, every cat boat is headed toward the scene, and the unsuspecting blue fish is apt to find himself in the boat.

The poor little fish have a hard life, between the ravenous monsters in the water and the no less cruel birds of the air. One may often look over the side of the boat and see thousands of minnows swimming alongside for protection. Little they would get even there if they were large enough to make man a mouthful.

Tern methods of feeding their young are very interesting. When old enough to fly they are led to some favorite rock and left there most of the time. The old bird coming with food is seen from afar off and greeted by the youngsters in the usual bird fashion, by cries and fluttering wings. The little fish or insect is usually dropped in passing, the young ones quickly snapping it up, for the old bird seldom stops for conversrtion. Terns are not sentimental creatures but probably their affections are just as deep as other bird's, though covered up by brusque manners.

At a later period, when the young are old enough to cruise with the flock, the old bird feeds them in a very pretty way. She alights gently on the water, and with head up and wings extended over her back, waits for the young bird to snatch the little fish from her bill as he passes in flight.

Both gulls and terns nest in large colonies, indeed, they are sociable birds at all seasons. Their architecture is

very crude, the eggs being often deposited on a shelf of rock, or in a depression in the moss or grass, or even on the bare sand. Often, however, a rude nest of small sticks, grass, sedges, or sea weed, is built. With few exceptions the nests are placed on the ground, but it is an interesting fact that on the Maine coast, where the colonies of herring gulls have been subject to a great deal of persecution, some of the birds have taken to building their nests in trees, often at a considerable height, In such cases, of course, the nest is much more carefully and compactly made. Bonaparte's gull also builds commonly above the ground, on stumps or on low bushes or trees.

The laughing gull likes the fresh and salt water marshes that line our coast in so many of our southern states, being content with a slight depression in the grass. Terns are very capricious in their choice of homes. A certain island or bit of shore may be selected and used for many years, man permitting, though apparently possessing no superiority of any kind over neighboring regions. And they will stick to their homes until the colony is almost exterminated. They are not at all particular, however, as to the exact situation where the eggs are to be laid ; on the bare sand, among the pebbles on the beach, or on a small collection of grass on the uplands ; it is all one to the terns.

Two or three eggs is usually the full complement to a nest, four being unusual, with either gulls or terns. They are green or brown commonly; and have spots and blotches of black, brown or lilac. One of my pet plans for the future has been to go to Muskegat Island, near Nantucket. This is the site of a large nesting colony, containing Common, Roseate, Arctic and Least terns, as well as Laughing gulls and Piping plovers. These birds are strictly protected and are flourishing. To this we may attribute the fact that the region of Cape Cod, and the islands south of it, is especially rich in these sea birds, and their extreme beauty

gives a charming touch of life to many a scene, that is lacking in most parts of our coast. For even the common tern no longer deserves his name. One might travel over many miles of New England coast, in summer, and never see a white wing, when formerly they existed in numbers.

As song birds gulls and terns are total failures. Hardy mariners are not usually noted for soft voices. These birds live the strenuous life, fighting for existence with gale and breaker. Their home is often placed just above the surf thundering against the rocks. So in order to communicate with each other they have developed voices that are shrill and piercing, loud and strong, useful but not sweet.

For particulars as to their individual languages, let me refer you to the text books. The terns are the only sociable ones I have met, the others of my acquaintance have usually maintained a discreet silence, as if recognizing that their language did not correspond with their swell clothes.

The moult of gulls and terns presents nothing unusual. Adults have two moults a year, a complete one in the autumn, the postnuptial, and an incomplete pre-nuptial in the spring. The chicks come into the world clad in brownish down, which soon gives place, by a post-natal moult, to the juvenal plumage, gray and brown with a great deal of mottling.

After several months occurs the post-juvenal moult, and in the case of the terns, the young then assume a dress that can be distinguished only by experts, from the winter garb of adults. After this the plumage of young and old is identical. Occasionally a bird skips its nuptial dress, and assumes in the spring the full winter plumage. This has led to the description of several new species that have only been ruled out in recent years, since the moult of birds has been critically studied.

In young gulls of the smaller species, such as Bonaparte's or the Laughing gull, a black band crosses the tail near

the end, and the black markings on the wings are different from adults, during the first winter. This serves to distinguish them. But at the first prenuptial moult they gain full adult plumage and can no longer be told from their parents. In the case of the large gulls, however, the young take two or three years in attaining mature dress The first year the young herring gulls are a dusky brown. These dark birds may often be seen in the flocks, and it is hard to realize that these birds can ever be as beautiful and snowy as the others. At each moult they lose part of the brown for white and gray, and, by the third year, their plumage might be called adult, though slight differences may be found in the primary markings for a number of years.

For many years the flocks of gulls and terns have been sadly depleted by natives and fishermen, and by hunters, as well, who have slaughtered thousands for the millinery market. There was a fair excuse for the former class, for the fresh eggs made a very welcome addition to a somewhat restricted diet, and even the young birds did not come amiss. There was even a good excuse for the plume hunters, who no less gained their subsistence at the expense of the birds, though in an indirect way. The former class had greatly reduced the birds in numbers, but the hunters would nearly have extirpated them in our locality had the traffic kept up a few years longer, Often hundreds were shot in a single day, by one party, and at the most destructive time, too, for the congregation of birds in huge colonies at the breeding season, made them easy prey in paying quantities. It was at this season that they were most extensively collected. The heads of families being thus destroyed, thousands of eggs were never hatched, and numerous young birds were left to starve. Many gulls were trapped in snares, and caught on baited fish hooks fastened in a row on long trawl lines. These methods were better than shooting for the plumage was not soiled with the blood.

Several states had laws protecting the birds during the breeding season, but nobody, as a rule, looked after the observance of these laws. But bird-lovers began to think hard when it became apparent that the beautiful sea birds that had swarmed in front of their summer homes were rapidly disappearing. About two years ago, efficient action toward their protection was begun. This section of bird protection was managed by Mr. William Dutcher, of New York, and consisted of two departments. The first aimed at stiffening the protecting laws, in some states, or procuring proper legislation where there was none, a work requiring much lobbying and lecturing.

The second department was to see that the laws were enforced. A small fund was raised by contribution with considerable difficulty, and work was begun in five states, Virginia, Maryland, New Jersey, New York, and Connecticut. Massachusetts had already protected the colonies of gulls and terns on her islands. The services of captains of life-saving stations were obtained to act as wardens. These stations are scattered all along the coast, and one could usually be found sufficiently near any nesting colony. In June or July the crews of the stations are off on vacations, and the captain is left alone with little to do. These men proved very efficient and became enthusiastic in the care of their wards.

Their reports, and the statements of ornithologists who supervised their work, show that nearly all of the colonies protected throve wonderfully, and the increase in numbers was all that could be expected. Last year a great step in advance was made by the passage of a protective law in Maine, where there are large colonies of herring gulls as well as terns. A short, but very vigorous, campaign by Mr. Dutcher and other interested people, carried the bill through, almost without opposition. Notices were posted along the coast, and wardens appointed, who did

good work, and in consequence the sea birds had the happiest and most prosperous season for many years. The result was shown almost at once, for the terns re-visited some of their old haunts in the Maine bays, where none had been seen for several seasons. In the last "*Auk*" there is an interview with an old bird hunter of Cape Cod, that brings good cheer to bird lovers. A year ago on October first, the day the law was off on gulls, he shot three hundred and seventy-five birds, and during the rest of the week about as many more. His neighbors also bagged a number, having been promised twelve and one half cents apiece for them, by New York merchants. The good cheer comes in here, the hunters could never collect a cent for them, thanks to the A. O. U., and the Lacey law, and our friend, the gunner "guessed shooting birds for hats was about over."

The scope of the work of protection has been considerably increased during the last year. Wardens have been appointed as far as Louisiana, and the Florida legislature was successfully appealed to, to pass a protective law, so that the small remnant of the state's former ornithological wealth will have some chance of preservation. The slaughter in the South has been terrible. Ornithologists owe a great deal of gratitude to the brave men who have interested themselves in this branch of bird protection. It requires bravery to hold up legislatures, as has Mr. Dutcher; it requires much bravery to hold up the people, and obtain the necessary funds, a work which has been entirely done by Mr. Abbott H. Thayer, of our own state. It is no less heroic to brave starvation, shipwreck, malaria and mosquitoes in visiting the breeding colonies, to direct the efforts of the wardens and assure their efficiency.

Should any of our readers feel moved to aid in the preservation of our beautiful sea birds, contributions, large or

small, may be sent to the editor of NATURE STUDY, who will gladly acknowledge their receipt, and forward them to the custodian of the fund.

Nature Study Lessons. I.

BY EDWARD J. BURNHAM.

It is proposed to make "Nature Study Lessons" a characteristic and permanent feature of NATURE STUDY. There are many parents, aunts, big brothers and sisters, who would gladly add to the pleasures of a walk afield by helping the little folks to "see things," if they themselves knew what to look for and where to find it. There will be no attempt at systematic arrangement in these papers. It is NATURE STUDY'S conviction that there has been too much of this in writings for children in recent years. The succession of backbones, somewhat broken, from the lancelot to man is of profound interest and deep significance, but is hardly within the comprehension of the child.

There will be for the present no attempt at dissection, and there will be little need of killing. Objects will be selected that are easily come by, and the lesson will be timed for the most favorable season of the year. In accordance with this plan we will begin with a short study of

THE FROG.

Frogs were in ponds and streams during the spring, where the females laid their eggs and the males made the nights noisy. Now they are mostly on shore, in meadows and moist fields, near water. Do not hurry to catch them, but watch them carefully. Find one that is still and see how he sits on his haunches. See what he does with his legs. Watch his breathing, especially observing his throat, sides and nostrils. See him wink or seem to wink. Sometime

you may be fortunate enough to see him catch something—a butterfly, a grasshopper, even another frog—for he eats almost anything that is alive and comes his way, and is not quite so big as himself. By and by drive him gently into the water and watch him swim. See what long, slow strokes he makes with his hind legs.

Now catch one, or better three or four, putting them in a small pail. It is always best to take a net along—the simplest kind, made of the cheapest netting or screen cloth with a wire ring on the end of a stick, is almost as good as a more costly contrivance.

Take a frog in the hand. Notice how soft the skin is; that it is colored above and white beneath. Notice how his color agrees with the plants and soil where he lives, making it harder for birds and snakes to find him.

Find the three parts of the fore limb—arm, forearm and hand. Count the four toes, or fingers, from inside outward. In some individuals the fourth finger is much thicker and stouter than in others. These are males.

Find the thigh, leg and foot in the hind limb. Count the five toes, and notice how they are webbed for swimming, and how very long they are.

Open the big mouth, and feel the small teeth in the upper jaw; notice that there are none in the lower jaw. Pull the tongue outward—soft and white, attached at the front end and free behind, so that it can be thrust out very far and very quickly.

Touch the eye gently with a pencil or small stick, and see what happens. Sometime look for the third eyelid in a turtle or any bird, and see how it resembles this eyelid or membrane in the frog.

The ears are back of the eyes, large and nearly round. They are made of a thin skin, or membrane, stretched tightly over a bony ring. This is like a drum, and is, in fact, called a drum—the tympanum.

These are a few of the things that may be learned about the frogs in a pleasant ramble on a summer day.

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Vol. III JULY No. 2

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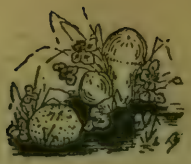

NATURE STUDY

A monthly magazine, published under the auspices of the Manchester Institute of Arts and Sciences. EDITOR: Edward J. Burnham. ASSOCIATE EDITORS: Frederick W. Batchelder, William H. Huse, Susy C. Fogg, Theodora Richardson.

Devoted to the encouragement of the study of Nature in her varied aspects—of the Rocks, the Birds, the Flowers, and all the multitude of living things that crawl or swim, or walk or fly.

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NATURE STUDY PRESS, Manchester, N. H.

Entered as Second-Class matter at the Post Office at Manchester, N. H.

STONE ARROW-HEADS

In Museum of Manchester Institute of Arts and Sciences. Collected in Manchester by Mr. James O. Harriman.

NATURE STUDY.

PUBLISHED UNDER THE AUSPICES OF THE

Manchester Institute of Arts and Sciences.

VOL. III. July, 1902. NO. 2.

Indian Implements in the Museum of the Manchester Institute. I.

BY WILLIAM H. HUSE.

When the museum of the Manchester Institute was burned last January, there was destroyed one of the finest collections of Indian relics in New Hampshire. This was one of the losses most to be deplored because the stone implements used by the aborigines of this locality are comparatively rare and are yearly becoming more so. This collection formerly owned by Mr. W. H. Heath, represented years of collecting, and contained specimens varying from the rudest chips to the most polished instrument produced by the latest skill.

Since the destruction of this collection another, and perhaps the only large collection in this city, has been secured. This is the fruit of many years of labor of Mr. James O. Harriman, an enthusiast of no little ability in the study and knowledge of such objects and the many things found in woods and fields. Years of research about the camping places of the natives of this section coupled with a

knowledge of the ways of the Indians of the West in recent years has rendered him expert in the discovery of Indian implements and the understanding of their uses.

To Mr. Harriman the Institute is indebted for such a valuable addition to its museum. The collection contains several hundred perfect pieces, besides other hundreds of fragments of all kinds. The arrow points predominate in number, naturally, as they must have been most numerous when these implements were used. Nearly two hundred arrow points are in the collection, varying in size from quartz points less than three-fourths of an inch in length to those of a size that renders it difficult to decide whether they were used on arrows or spears.

There are two places within the bounds of Manchester where the Indians had camps, probably permanent. Amoskeag Falls, which brought white men here and made Manchester, brought also the red man. He, however, came to fish, for the rapids in the river at this place with numerous rocks from which to fish and the eddy below into which would descend the weaker ones that failed to ascend at the first attempt, made it an ideal place for the fisherman when the river was unobstructed by dams, and alewives, shad, lamper-eels and salmon came up by the million with each recurring spring and summer.

At Amoskeag there was a large village until the white man came. Here the craftsmen, that fashioned the rude but effective implements from stone, lived and plied their calling. Chips have been found by the bushel on both sides of the river. Here tools of all kinds would be lost and remain undiscovered until the white man's ploughshare turned them up or excavations brought them to light.

About four miles south of Amoskeag Falls, Cohas brook enters the Merrimack river, bringing to it the water of Lake Massabesic, situated a few miles east. Half a mile below the outlet of the lake is a sandy plain on which there must

have been a camp of the Indians, judging from the number of implements of all kinds that have been found there, together with chips in abundance.

At this place the brook is shallow and the catching of alewives and lamper-eels was comparatively easy. From these two places most of the specimens of the Harriman collection came.

The arrow points are made from about all the varieties of rock that could be fashioned into shape and be used for the purpose intended. Quartz was the one mineral that was locally the most abundant, and from that many points were made. The dark varieties of igneous rock that are found here only in narrow dikes or boulders brought from northern ledges were also used. Besides these, many points are made from flint or chert of various colors. This is a material that is not found in this State and must have been brought from other sections. This would mean excursions on the part of the implement makers or the exchange or purchase of either the material or the finished artifacts.

The various forms of the arrow points are worthy of study. Representative shapes are shown in the cut. The triangle, the long, slim form, the point with barbs, those without, and all the multitude of varieties were made for different uses or kinds of arrows and were also dependent, I suspect, upon the shape of the original fragments and the way the chips fell off.

A Rich Inheritance.

BY EDWARD J. BURNHAM.

In one of his greatest novels, Dickens, himself a keen observer, says: "I believe the power of observation in very young children to be quite wonderful for its closeness and accuracy. Indeed, I think that most grown men who are remarkable in this respect may with greater propriety be said not to have lost the faculty than to have acquired it; the rather as I generally observe such men to retain a certain freshness, and gentleness, and capacity of being pleased, which are also an inheritance they have preserved from their childhood."

It is remarkable how many people fear to be childlike, lest they appear to be childish. Mistaking repression for culture, and confounding indifference with refinement, they check enthusiasm and conceal emotion until they destroy the one and become incapable of the other. Never permitting to themselves the joy of a surprise, they miss much of the flavor and zest of life, become world-weary, and grow old at heart before their time. They have thrown away an inheritance of their childhood, and have lost the capacity of being pleased.

On the other hand, to such as those of whom Dickens wrote, each succeeding sunrise is as wonderful as if it were the first outpouring of light in the beginning. They find delight in the flowers, rejoice with the birds, are openly enthusiastic and are not ashamed. Such can hardly be said to grow old. They have preserved the capacity of being pleased as a rich inheritance, and have come as near the fountain of perpetual youth as is permitted to mortals.

Nor is it at all doubtful that the power of observation, a

part of the same inheritance, may be held through life with a little care. The tendency of education has been, and to a great extent still is, toward the development of the reasoning at the expense of the observing faculties. But in the actual affairs of life the capacity of quick and accurate observation is as essential to success as is the power to reach correct conclusions. The one faculty should be developed equally with the other; or, rather, while the one is being developed, the other should be carefully preserved, and to aid in its preservation is the proper function of nature study, whether in the home or in the school.

An Aristocratic Family. II.

BY FREDERICK W. BATCHELDER.

As stated in the last article, all the wonderful transformations which have taken place in the flowers of orchids, making them so very unlike the original type from which they are doubtless derived, are in the interest of cross-fertilization. For some reason, neither easily assigned nor explained, it has become necessary to the orchid that any flower shall be fertilized by pollen from some other flower. The exceptions are so few that they only serve to prove the rule.

Now in all flowering plants fertilization is effected by the action of pollen brought in contact with the stigma. Pollen is distributed in two ways: first, by simple gravitation and by currents of air; second, by the aid of insects. That which is to be broadcast by the first method is usually produced in great abundance, so that waste of material is of little consequence. In the other case greater economy prevails, and, as we shall see later, in the orchid family this economy is carried to the farthest limit. Between the wind blown pollen of the pines, which, in the flowering season,

may fill the air with clouds of yellow dust, and the single or double insect borne pollen-sacs of the higher orchids, there is a difference as instructive as it is amazing.

The pollen of orchids has, in fact, become specialized to such an extent that it differs from ordinary pollen as much as orchid flowers differ from ordinary flowers. It has been specialized as to consistence and coherence and viscidity, and the sacs containing it have been specialized as to shape and location, and in some cases have even developed the power of automatic movement. The orchid not only takes pains to secure pollen from another flower but it tries as carefully to prevent its own pollen from coming in contact with its own stigma, as if that in itself would be sure to injure it. The way in which both these ends are secured is finely illustrated in the two species of lady-slipper described in the last article.

The slipper or pouch is in reality an insect trap, which the insect may enter easily but from which he cannot depart until he has paid toll by doing his jailer's bidding. Take now the case of the yellow lady-slipper, where the lip is actually shaped like a babies sock. This lip is, roughly speaking, spheroidal in shape and there is a fine large opening in the top. Attracted by something, probably the odor of a nectar-like secretion within, the insect boldly enters. He then finds himself on the concave inner surface of a golden sphere, delights himself with such sweets as he may find there, and when satiated tries to get out the same way he got in. There is the great opening in the top, through which he may see the sky and the sun. Surely here must be a free exit. So he starts to crawl out. But the surface near the opening is very slippery. There is nothing to cling to and he falls back. Not daunted he tries again. Perhaps he is able, in spite of slipping, to reach the very edge of the sky-light. But here he encounters a fresh obstacle. All around the edge there is a fence, the top of

which is bent inward in such a way that he cannot possibly crawl out. So down he slips again. Even if he has wings he cannot fly out, for the space is not large enough for him to start in, and he only buts against the opposite side of his prison, just as a fowl flies against the high fence that encloses the hen yard. When he has become tired of trying this avenue of escape he pokes around the bottom of his cell to find some other way out. There is an opening in the middle of the back of the slipper, where the edges of the base of it fold the one over the other. But he cannot reach this, for there is a queer looking, shield-shaped screen right in the way. He is thus barred from exit by the back door. He keeps on trying, however, and finally discovers, on each side of the screen, a little side door, a narrow opening through which, if not too large himself, he squeezes and at length comes out into the great world again. If, unhappily, he is too big to squeeze through, or if he is not bright enough to enlarge the opening by eating around the edges of it, or if he has been narcotized and thereby weakened by the juices or effluvia of the plant, he may remain a prisoner and the golden sphere may become his tomb.

That this calamity overtakes some visitors is evidenced by the fact that the remains of the larger insects are frequently found within. A number of these flowers collected this season were examined and a dead bee was found in every one. In our own garden we have had a curious illustration of the fact. Our yellow lady-slippers did not develop well this season and but a single plant produced a flower. When the blossom had withered we had the curiosity to look into the slipper,—and what should we find there but a bee, dead as a door nail!

When it kills the bee, the plant does toom uch and defeats its own ends. The bees and other insects have served it a good turn. The way they have done so is this :

In crawling out through one of the little side openings the insect has first to pass close to the stigma and next close to the anther. We will suppose the visitor to be making his first morning call, and to have as yet no pollen adhering to him. He brushes past the stigma, but of course leaves no pollen on it. When he reaches the anther, the delicate membrane which covers the anther cells is ruptured and some of the pollen, which in this species is viscid, sticks to him. Having emerged, he seeks another flower. In making his exit from this he first brushes past the stigma. This is beset with sharp points, all directed forward, which favor the deposit of some of the pollen on it. So flower number one has not only prevented the insect from leaving its own pollen on its own stigma, but has also commissioned him to transfer some of the pollen to flower number two. In this way the process of cross-fertilization goes on indefinitely at the same time and by the same means that self-fertilization is effectually prevented.

In the stemless or pink lady-slipper the process is the same, though the development of the lip is quite different. Instead of a free opening in the top there is a closed fissure in front which may be essily forced through from without, but not from within, by reason of the edges being folded inward, so that exit has to be made by the same outlets as in the other species.

In the flowers of Cyripedium, then, the changes which have taken place in the interest of cross-fertilization are, briefly, these: From a regular flower with three sepals, three petals, three outer stamens, three inner stamens and three pistils there has come a very irregular flower. The three sepals remain, though two of them are often apparently united into one; two of the petals remain as petals, while the third has been changed into the slipper-like or pouch-like lip; two of the outer stamens have been suppressed, while the third has been developed into some-

thing very unlike a stamen; one of the inner stamens has been suppressed and the other two reduced to sessile anthers; the three pistils have coalesced into one, and a slightly three-lobed stigma is the only present reminder of the former triple character. The lip has become an insect trap in which visitors are temporarily detained and from which they can escape in only one way; the outer stamen has become a wall to bar their exit by any but that particular way; the anthers are so located with reference to the stigmas that they cannot be touched until that has been passed by.

Yet with all these transformations and adaptations the genus Cypripedium has undergone the least change of all the genera in the family, and it appears to be almost the only remaining representative of an early stage in the evolution of what may be called the orchid plan.

A Wren Incident.

BY JANNETT MCINTOSH.

In front of our dining room windows, facing south, was a low appletree. A small wooden house suitable for the wrens had been placed in a notch of the tree, and we were anxious they should occupy it. In the other trees were fastened larger boxes for the bluebirds.

Although our home was suburban and the field and woods stretched far away to the southward, the detestable English sparrow voices were heard as clamorous and quarrelsome as in the city streets. Quite naturally they, too, liked the houses provided for the wrens, and the bluebirds, being less timid, drove them away. A pair of wrens began building, but were unable to make as resolute a stand. I therefore became their champion and literally fought with sticks and stones for several days before the sparrows

were overcome and the wrens allowed to continue and complete their many-times-begun housekeeping.

The conflict lasted from early morn to dewy eve. The dawn of day was ushered in with the cry of the sparrows as they flew back and forth with material for the nest. Their persistency filled me with rage, and if angry words could have annihilated them there would have been one less pair to perpetuate their species. As oft as the sparrows were ejected, the wrens returned. When the sparrows came to understand that the house was for the wrens (and this idea did at last penetrate their brains) it was comical to listen to the male every time any of the family appeared in the garden, as he stood on the ridgepole of the house, while his mate flew from tree to tree, adding her cry to his. This was kept up for a whole day. when they retired and left our bird family in peace.

Then began the love-making and the home-building, which we watched with interest from day to day ; she, the industrious little mother, hurrying to and fro with the soft bits of material necessary for the nest, he sitting on a limb near by and singing his love song as if inspired. When she came near, tarrying for a moment to receive his loving attention, meanwhile uttering low responses seeming to have a note of rebuke at his lack of energy in not assisting to bring the portion of the material for the construction of their home, she seemed the embodiment of restless, active motherhood preparing for the new duties of maternity.

Once I happened to notice her carry from the ground a three-pronged twig. She had secured it by the shorter end and found it impossible to get it through the small opening. Again and again was it taken, only to be dropped ; meanwhile small pieces of soft feathers were placed within. Evidently this particular twig was consid-

ered most desirable for the foundation, and it was several hours before the small end was at last securely taken in her tiny bill and thus successfully carried to its place in the little house. Such persistency and indomitable pluck were unexpected in this mite of a bird, and it was with a sigh of relief we saw her thus rewarded.

Manchester, N. H.

Winter Friends.

BY GUY EMERSON.

After the bright autumn leaves have fallen, and the summer birds have taken the long flight to their winter homes, we are visited by the little ones with plainer coats, yet with no less good cheer.

They come in small numbers, yet does it not seem that nature cooperates with us as bird lovers? For when the trees are thickly covered with leaves, thus making it difficult to observe birds, there are more of them; but as the birds become less plentiful, the leaves obligingly fall off, so that we see the *few* as plainly as possible.

Of these birds which come to us in winter, I like the five which I call the "Winter Friends" very much; these are the Chickadee, Brown Creeper, Downy Woodpecker, White-breasted Nuthatch, and Golden-crowned Kinglet.

They enjoy each other's companionship exceedingly, and join forces about November first or earlier; after that time until March, one can rarely see one of the five, without noting some of the others near by. I have been fortunate in having a company of Winter Friends near me this serson, and it has been one of my greatest pleasures to watch them.

The group thus formed always finds a suitable location and rarely leaves it.

Let us go into such a place ; the air is clear and cold, and the sun is shining on us from a beautiful blue sky. We enter a wood of oaks and maples, bordered by low bushes, and soon we hear a few "cheeps" and a spirited "dee-dee-dee." Drawing near to the sounds, we see a chickadee cleverly searching the branches. We have found a company of Winter Friends, so stationing ourselves in their line of march, we watch them all pass by.

The next one we see is a Creeper, hitching rapidly up the trunk; calling occasionally, now dropping a small bit of food and catching it before it has fallen a foot, now travelling in an irregular spiral course. If it were just after a rain or snow, however, he would go straight up the dry side of the tree. He has disappeared behind the trunk, so let us watch the chickadees. One is on the tip of a little twig calling "chickadee-dee-dee-dee" or "ker-tsic-er-deek." If we whistle to him he may answer "phœbe," for he is such a cheerful little fellow that he would brighten the most dismal surroundings.

Near him are three tiny kinglets, flitting about ; now dropping into a hedge so that we can approach within two feet of them and see their bright crowns. How funny that little one looks on the ground, almost hidden by one of the leaves among which he is searching for tidbits.

The main part of the band has gone by when we see a flash of white, and Downy flies straight at a tree, and begins to climb up the trunk, stopping to hammer the bark in his search for food ; once in a while he calls, and as he turns his head to look at us we see the red on the back of his head.

We have been so interested with the other kinds that we have not noticed the Nuthatch who is a little to the right of the group; now he calls "yank, yank" loudly, and we see him, head downward, looking at us with interest. But he can spare us only a moment, for he is, like the other

Winter Friends, very industrious; so he runs quickly over the larger branches of this tree, and then flies to another, always following his friends.

Thus we have seen them all, and go away well pleased.

One day, however, I missed Downy. I searched carefully through the accustomed haunt, but in vain. At last retracing my steps, I heard the familiar call within six feet of me, but look as I would, I could see no bird. I was puzzled; here was the well known call coming from somewhere nearby, and yet no Downy was to be seen. After about two minutes I saw a small, round hole in an old tree and, carefully drawing nearer, saw that a crack ran down the tree from the hole about eight inches. Through this I perceived the object of my search sitting somewhat head downward. When I came too near, he flew away and probably joined the band again.

So, all winter, these little birds travel about each day, searching the trees with greatest care for insect's eggs and larvæ; and going over the same trees the next day, they find just as much to be done as before. The good they do can easily be understood.

As spring draws near we note various changes in our little company. The Nuthatch is joined by a mate, and perched crosswise on a branch, often gives the laughing "yah-yah-yah-yah" which is his song. The tattoo of Downy is heard, and it is no longer necessary for us to whistle to hear the sweet "phœ-be," "Spring's near" of the Chickadee.

If we are lucky, we may hear the clear, four or five note song of the Creeper. It reminded me of a Meadow lark's whistle heard from a distance. A more common call of the Creeper is one of six notes, the third, fourth and fifth just half the length of the first, second and sixth. This has been said to resemble the song of the black throated green warbler's "Trees, trees, whispering trees."

Even the kinglets sometimes vary their usual "zee-zee-zee."

As warmer weather approaches, the company grows smaller and smaller, and the several species go off by themselves; till, when the Redwings come singing from the south, our little "Winter Friends" catch the impulse to be gone, and part company till the cold shall come again.

Brookline, Mass.

Aids in Geography.

A recent number of the Boston *Transcript* has an interesting article descriptive of the commercial museum at the English high school in that city that is used in teaching geography. Specimens of wool from different breeds of sheep and various countries familiarize the pupils with that valuable product. Cotton in all its varieties is there to be studied. The many articles made from cork, the different conditions of rubber, the various food plants and their seeds are shown, and the high school students get their information first hand and do not depend upon books.

This is a sample of the ways of the new geography and modern methods of teaching. Pupils do not get all their information from books, and both understand and remember it better. Such school museums are not confined to Boston, however, but can be found in the grammar schools here in Manchester. In the Hallsville school, for example, can be found a collection of specimens to illustrate geography that is continually growing and is already of value to the pupils and teachers in school work.

This collection was recently examined by a *Union* reporter who had been wondering if Boston were alone in this kind of work. In the modern geography the pupils study about the processes that are changing the aspect of the earth today. To illustrate the weathering of rock is

found a series of specimens ranging from the unweathered fragment taken from the quarry to the brown soil which is the same rock oxidized by the weather. The formation of sand is shown by a similar series. A half dozen specimens show the history of coal from peat to the hardest anthracite, while pieces of shale with impressions of ferns and leaves tell the story of the production of fuel. Pieces of wood and bark from the big trees of California with a string that shows the exact circumference of one of them as measured by a lady who gave the specimens to the school, make the giant trees more real to the pupils. Trays of coffee from the berry just as it is picked from the tree, to the roasted kernel ready to be ground, teach the classes more than books alone can tell. Dishes of tea, illustrating the various kinds that are dear to tea lovers, tell an interesting story and make the children wonder if the peculiar flavor of gunpowder tea is due to the perspiration of the hands that roll it into little pellets. The common ores help in the study of mining; specimens of rubber in various stages of completeness, in connection with a growing rubber tree, illustrate the geography of the tropics; building stones and the different varieties of marble tell an interesting story; and many of the commercial woods are in the collection.

Pieces of rope of various fibers are exhibited, and the pupils learn that more sisal in value is brought into this country than any other fiber. The sisal plant grows in Mexico and somewhat resembles the common century plant. A growing plant in one of the school rooms is an ornament to the room and teaches geography at the same time. Manila rope is made from a species of banana that grows in the Philippines. No specimen of this species is found in the school, but a banana plant from Florida which is sending up leaves at the rate of five inches a day is a constant source of interest to the children.

In connection with these specimens more than a thousand lantern slides illustrate the text of the geography and make it real to the young students.—*Manchester Union.*

Frogs I Have Seen.

BY O. H. LEAVITT.

I was fishing for perch, standing on a rock which ran out a few feet into the pond, and throwing the fish into the bushes on shore, when I heard a rustling and looked around and saw a large bullfrog swallowing a perch which was longer than the bullfrog was in his natural condition. He could not stretch his body quite enough to cover the whole of the fish, but went off happy with the fish's tail sticking out of his mouth.

Near the same pond I picked up a turtle about two inches across and, after looking at him a few minutes, threw him into the water, where he was seized by a frog and swallowed whole. The head of this frog was not more than an inch and a half wide in its natural position.

I once sent a hired boy on an errand which took him through the woods by a wood road. He came back and said he had found a snake with legs. He appeared so honest about it and so sure that I went with him to see for myself. And I did see—a green snake which had swallowed a small frog, hind legs first, until the forward legs, being spread out, stopped the operation, and the snake's mouth, being of the same color and stretched so thin that it fitted closely, was a better deception than Barnum's mermaid.

So far there has been only one frog to a story. The next one has two frogs and a toad. I had a tame owl, and in foraging for him I took a large bullfrog and cut it open, so the owl could begin on it. Inside of the frog was a toad, still too large for the owl to tear open, so I cut that also, and found a small frog inside the toad—the combination illustrating how frogs and toads can "dwell together in harmony."

Nature Study Lessons. II.

BY EDWARD J. BURNHAM.

In one of his prettiest stories, Richard Jefferies tells how a fern once taught a little boy a great secret—that if he wanted to know anything, or to hear a story, or what the grass was saying, or the oak-leaves singing, he must be careful not to interfere; for if he interfered with one thing, it would tell another, and they would all know in a moment, and stop talking, and never say a word.

Ferns do not tell their secrets to little boys nowadays; but everyone who wishes to learn for himself of the intense life all around him in the woods and fields and streams, must first learn the grand secret which little Saint Guido knew. When one goes abroad into the great company of living things that crawl or swim or walk or fly, he must be very quiet and careful. Otherwise, although thousands of eyes are peering at him, he will scarcely know he is in such company at all.

Many rare opportunities for observation are lost because those who go abroad do not know how to behave in the company they seek; and children are not the worst blunderers. Talking, laughing, a heavy footstep, the flourish of a stick or cane will cheat the entire party of many a pretty scene or pleasurable discovery. Haste to kill or catch is as bad as noise—perhaps worse. It is unusual for the sportsman to know much about the creatures whose lives he seeks. He shoots at sight, literally "bags" his game, if successful, and, if he cares for further information, seeks it in books. The mere collector, also, who thinks only of adding to his collection, commonly has little more than the dead bodies of his victims for his pains. By catching and killing, instead of watching, he has missed the chance to

learn much that would be of great interest and value to others as well as to himself.

In order to understand many things about the ways of wild creatures, we must know something of their structure, and so must study their bodies. If public libraries and schools had good museums, as they ought, there would be little need of our catching and killing on our own account, and we could give all the time we have for rambles to "seeing things." As it is, while we must kill a few individuals for study, we shall find that, if we go about it rightly, we can learn much more from live creatures than dead ones. In this lesson, or ramble, we will try to learn something about

THE BUTTERFLY.

When you see a butterfly skimming over the field, hovering about a blossom, or resting upon a leaf, you may feel sure it is not seeking its own pleasure merely. Such expressions as "a butterfly existence" simply betray ignorance. The butterfly takes life very seriously. It has but a few weeks to live at the longest, and half its days may be clouded, if not actually stormy and cold. In its brief life it must not only seek food for itself but must find a particular kind of plant, favorably situated, upon which it may place an egg here and there—or it may be, if the plant is small, only one egg to a plant. It is not always a simple matter to find suitable plants that have not been appropriated already, and while anxious search is being made there are innumerable deadly perils to be escaped if possible. So when we see a butterfly, we may be sure it is at work, or resting to gain strength that it may work again.

To see any creature living its life naturally we must learn, as little Saint Guido did, not to "interfere." We must be silent, move very slowly, sometimes remain per-

fectly still for a long while, and always be hidden as much as possible. There must be no ribbons flying, and it is best, when we can, to keep ourselves between our shadows and the object. If, while still at a distance, we watch some particular butterfly, as the Monarch or the Viceroy, we may find it is visiting flowers, to sip the nectar, or some special kind of plant, to deposit its eggs upon the leaves. For the butterflies are wonderful botanists, and each kind knows just what plants produce the right sort of leaves for its young to feed upon.

Perhaps there may be such a plant near a tree, a stump, a bunch of tall grass, or clump of bushes. If so, we have only to hide and wait patiently for a visit, for that butterfly or one of the same kind will come sooner or later. If there is a good clump of bushes, but no plants of the right kind near, either bring some of the bushes and stick them in the ground near the plant, or dig up the plant and set it out by the bushes. Then nestle down as still as still can be, and in a little while, as Saint Guido would say, "the magic will begin."

Bees will fly humming around; beetles will come seemingly from nowhere; quite likely a bird will hop from twig to twig close by; a cricket will chirp; a big spider will begin mending its web, and by and by the butterfly will come. Notice that when at rest it holds its wings straight up, back to back. This is unlike the moths, which hold their wings flat or cover their bodies with them at an angle, like the roof of a house. See that the front pair are within when the wings are raised, and on top when lying flat, and see if you can think how this would help to make the two wings of the same side work together in flying. Which pair is the larger and stronger?

Notice the difference in the color of the upper and under side of the wings, and see how well the brighter under side corresponds with the flowers on which it rests, while

in flying the plainer upper sides are less conspicuous. Try to think how this helps the butterfly to escape its many deadly enemies.

If we are close to the butterfly when at rest, we can see its legs. What does it do with them? Can a butterfly walk? If it wished to move along a few inches, would it use its long, slender legs, or would it rise on its strong wings, fly about a moment and finally settle where it wished to be? Some legs are fitted for jumping, like a grasshopper's; some for running, like an ant's; some for slow walking, like some clumsy beetles', and some for clinging, like the dragon-fly's. Which kind does the butterfly have?

If the butterfly is feeding, we may be able to see it make use of its long, slender tongue, but as that, together with the antennæ and other parts of the body, is most satisfactorily studied with the insect in hand, we will leave it for some rainy day or winter evening at home.

As we become accustomed to keep a sharp lookout, and learn what to look for, we shall frequently find butterflies laying their eggs. These are tiny, but can be seen with good eyes, and under a magnifier are very beautiful. We must notice on which side of the leaf they are always placed, and what kind of plants are selected by each kind of butterfly. Some of the eggs may be carried home and placed in a jelly tumber, with some cheap netting or screen cloth over it. When the young caterpillars appear, they must be fed on leaves of the same kind of plant that the eggs were found on. In this way the growth and changes of the caterpillar can be watched, until the chrysalis is formed, and at last—often in a few days—a new butterfly appears.

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Vol. III AUGUST No. 3

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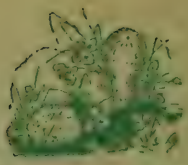

NATURE STUDY.

A monthly magazine, published under the auspices of the Manchester Institute of Arts and Sciences. EDITOR: Edward J. Burnham. ASSOCIATE EDITORS: Frederick W. Batchelder, William H. Huse, Susy C. Fogg, Theodora Richardson.

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Entered as Second Class matter at the Post Office at Manchester, N. H.

STONE SPEAR-HEADS.

In Museum of Manchester Institute of Arts and Sciences. Collected in Manchester by Mr. James O. Harriman.

NATURE STUDY.

PUBLISHED UNDER THE AUSPICES OF THE

Manchester Institute of Arts and Sciences.

VOL. III. August, 1902. No. 3.

Indian Implements in the Museum of the Manchester Institute. II.

BY WILLIAM H. HUSE.

The spear heads in the Institute collection are fewer than the arrow points. There were fewer to lose and therefore not so many to be found. Spear heads were made in the same way as arrow points and resemble them in shape. The only way to distinguish them is by size and weight. The smaller are undoubtedly arrow heads. When the size was such as to make the points unwieldy on the arrows they were used as spear heads. Sometimes when the length and width of a piece are hardly enough to place it among the spear heads, its thickness and weight will thus classify it.

In the cut there is one piece that is so dull as to make one in doubt as to whether it were not used as a scraper. It was put in with the others, however to show all possible forms in the collection. The specimens shown are fairly representative of the pieces collected by Mr. Harriman whose indefatigable zeal has preserved for Manchester so many priceless relics of the past.

The materials of which the spear heads are made differ as much as those of the arrow points. Many of them are made of stone that is not found in New England and must have been brought here either in the finished implements or in flakes. Such a variety of materials has been found here that it has been thought by some, and with apparent good reason, that here at Amoskeag was the trading place or bazaar for the Indians of this vicinity. To the permanent village at the falls, kept here by the numberless fish in the river, came the implement makers and traders from the different villages and tribes. Here the resident artificers made their points of quartz and various other igneous rocks. Hither were brought the flakes of flint and chert from the south and west and exchanged for goods or sold for wampum. Here are found chips of all kinds by the bushel and implements by the thousand have been picked up and carried away.

Notes on the Growth of Trees.

BY O. H. LEAVITT.

The manner of feeding trees and plants followed by many people shows that they have the impression that, as with the living animal, anything put within reach of the mouth goes to the benefit and support of the whole body. That such is not the case in tree growth is shown in many instances. It seems like a tangled path for sap to follow from the end of an elm-tree root several rods away from the trunk, up through the crooked and twisted fiber of the body and out to the ends of the branches on the same side of the tree, but I have noticed many instances which showed that each root or system of roots had a given portion of the trunk and top to support. I will begin with local cases.

When there was a stable where the Manchester House

now stands, or in the rear of there, and a hogyard in connection therewith, the elm tree which stood opposite that spot in the common sent its long, drooping, thrifty branches over in that direction, growing faster than any other part of the tree, notwithstanding they were sent out away from the sunlight.

At the same time another tree in the same row, standing near the head of the pond at the east end of the Common, where its roots found the muddy water, grew as much out of proportion on the side next to the pond.

An elm standing just outside the lot which I use for a flower garden, and which was surrounded by comparatively barren and wholly uncultivated soil when I began there, has found the fertility in my garden, and the branches on that side have grown much more than on any other part of the tree.

A white ash, standing in the road several feet from the wall and near a neglected field, felt the influence when the field was plowed and manured ; the branches grew longer, and even the trunk, on the side fed by those roots, grew faster, until the tree, instead of remaining round, assumed an egg shape, the point being toward the field. This change in form was the result of more rapid growth and thicker annual rings, as I proved by cutting the tree for use and examining it.

All these cases show that it is not necessary to put the plant food at the base of a tree trunk. The fine roots are the foragers, and anything in their range will not only be appropriated, but will be credited to their special account in the growth of the tree.

An Aristocratic Family. III.

BY FREDERICK W. BATCHELDER.

"Will you walk into my parlor ?"
Said the orchid to the fly,
"Tis the prettiest little parlor
You ever did espy."

So sing the flowers to the insects. So sings the lady-slipper to the bee, and, as we have seen, often lures him to destruction. But the lady-slipper does not mean to kill the bee. She only wants to use him to carry her parcels for her. If he is too stupid to find his way out, that is his affair, not hers. The lady-slippers (*Cypripedium*) have, in the course of time, evolved an insect trap, a place of temporary detention, from which there is but one way of exit, and that by the prescribed path. This is so laid out that the anthers cannot be touched until after the stigma is passed by. In this way cross-fertilization is ensured and self-fertilization prevented at one and the same time.

This genus, Cypripedium, differs more from all the other genera of orchids than the most unlike of those differ from each other. It is, in fact, almost the sole living remnant of an ancient type, its cogeners having perished in the struggle for existence. The other genera of orchids have undergone even greater changes in structure. The sepals and petals remain essentially the same. In Cypripedium one of the three outer stamens remains in a rudimentary condition and constitutes the screen-like body which prevents exit by the rear centre ; in the other genera the corresponding stamen is the only fertile one. In Cypripedium two of the inner stamens are fertile : in the other genera none of them remain as stamens. In Cypripedium the three stigmas are faintly indicated lobes of the stigma : in most of the other genera one of the stigmas has been mod-

ified into the extraordinary organ called the "rostellum' or beak, while the other two are merged into one. The few exceptions need not here be considered.

In some exotic species tactics similar to those of the lady-slipper are employed and the lip is made a sort of trap. In most orchids less dangerous methods—to the insect—are used. He is simply invited to partake of sweets and then allowed to depart without delay, though not always without inconvenience, as we shall see.

It is most likely that fragrance in flowers is to insects the primary attraction, and that they have learned, as races if not as individuals, to associate fragrance with the presence of nectar. Probably color is a secondary attraction; at any rate, many species of orchids have nearly colorless flowers, and observation shows that such are no less productive of seed than the more gaily colored species. The insect, then, drawn by the odor and perhaps by the color of the flower, flies to it and naturally alights upon the most prominent and convenient part of it, which is in this case the lip. The lip is usually pendent, though occasionally, for good and sufficient reasons, it may project nearly or quite in a horizontal direction. On the lip there are often lines or depressions which serve as guides to the nectary at its base. In the different genera various ways have been contrived by which guests may be made to serve as express messengers. In some cases only a little or a part of the pollen is removable, in others the whole of it. In some it is detached in thin plates, in others in compact masses.

The genus Habenaria includes some of our most beautiful and also most familiar orchids. To it belong the gorgeous purple fringed orchids, *H. fimbriata* (*grandiflora*) and *psychodes* and the common ragged orchid, *H. lacera*. It is in this genus, and the allied genus Orchis, the type of the family, that the specialization of the pollen has been carried to the greatest extent. The single anther produces

two cells of pollen which are located on each side of the stigma and are more or less separated from each other in the different species. In fact, the genus has recently been cut up by Dr. Rydberg, into seven genera. Whether he is right or not is a matter for the systematists to decide. Each separate, club-shaped mass of pollen (anther sac) is narrowed toward the base into a slender thread (caudicle) and to this is attached a disc or gland of very viscid matter. The use of this sticky gland will soon be apparent. We will suppose the insect to alight on the lip and to crawl toward the nectary at the base of it. As he presses forward to insert his proboscis some part of his head will strike against the glands. These will adhere to him with such tenacity that when he backs out of the flower he will tear the whole pollinium off and fly away with it. When he enters another flower, if everything works right, he will thrust the large end of the pollinium against the stigma. When he withdraws, part of the pollinium will adhere to the viscid stigma, the delicate membrane which encloses the pollen will be ruptured and some of the pollen will remain on the stigma. In this case the only harm that comes to the insect is the inconvenience of lugging around one or more pollinia which must to him appear quite large and burdensome. Sometimes these impediments become attached to the eye, sometimes to other parts of the head, sometimes to the proboscis. A proboscis encumbered with half a dozen or more of these bundles must be nearly useless and its owner in danger of starvation.

But this is not the whole story of the pollinia. It might happen that they would not be in the right position to strike the stigma of the next flower; in fact, when they first adhere to the insect they are placed at such an angle that they would not strike it, and all contrivances up to this point would have been evolved in vain. By a refinement of specialization so wonderful that it would scarcely be cred-

ible if its operation were not plainly visible to anyone who cares to look, the pollinia are capable of automatic motion. At first they diverge too much and would, if inserted in that position, strike one side of the stigma ; but after a few seconds they begin to undergo a movement of depression forward, so that about the time the insect should enter another flower they point directly forward and will be in position to strike the stigma.

This phenomenon may be observed by anyone who can procure one of the later fringed orchids, *Habenaria fimbriata*, *psychodes* or *lacera*, either of which may be found in certain localities during the month of August. By inserting a sharp pointed pencil or a toothpick or a bristle in the direction of the nectary one or both of the pollinia may be withdrawn and the movements observed. It will be interesting to note how many flowers in a spike have already lost their pollinia, and how many of the stigmas have had pollen brought in contact with them. The best of all will be to watch an insect while he performs his office.

It would be useless to attempt a description of all the methods used by this aristocratic family to secure the one end and aim of their existence, cross-fertilization. I will name now only certain adaptations which occur within the genus we have been considering, Habenaria. In some species the anther sacs are so widely separated that an insect proceeding directly to the central nectary would touch neither of them. In *H. Hookeri*, for example, this contingency is provided for by curving the lip upward, instead of downward as usual, and also by almost dividing the flower into halves, so that the insect is compelled to go to one side or the other in approaching the nectary. In *H. flava* (*virescens*) the same end is accomplished by the production on the lip of a ridge or "nasal protuberance," as Gray calls it.

In the next article of this series I will give a brief summary of the orchids found in this vicinity, their habitat and time of flowering.

Under the Pines.

BY DOROTHY MAY.

The Pine tree, it seems, is rather in disfavor with Park Commissioners because grass will not grow under it. Ah, but other things will. And how the heart of the nature lover is stirred at the thought of them! It is always enchanted ground where care and trouble fade away like a dream of the night, under the pines. Even in November, that "leanest month of all the year," the fierce winds that sweep in wild gusts over the uplands, that whistle shrilly through the naked branches of the oaks and maples, and whip the dark waters of the lake to white-capped waves, are hushed to sweetest music under the pines. Summer has made her last retreat, and marshaled her invincible and unyielding greens to meet the snows of winter, under the pines. The stones and logs are covered with mosses—the brave mosses, oldest of plants, that climb the high mountains, and penetrate the frozen north, and show their most of beauty in the bleakness of late autumn or early spring. The evergreen ferns lift their graceful fronds above the carpet of pine needles which yields to the tread with luxurious softness. The lycopodiums, that look like miniature pines, gather in little colonies. And scattered here and there are the rich greens of plants whose blooms made sweet the air of summer days. The shining, dark leaves of the pipsissewa, and the white-veined ones of the Michella, whose tiny, white, velvet blossoms, with perfume suggestive of Mayflowers, are replaced by scarlet berries, and the rattlesnake plantain, also white veined, whose orchid-like blossom looks like a spiranthes untwisted. The three

pyrolas—the *P. rotundifolia*, light-veined, too, the *P. elliptica* with richest perfume, and the *P. secunda* whose drooping bells look like lily of the valley. Goldthread, the petals of whose fragile white stars dropped at a touch, and the purple green of fringed polygala, "May Wings," Susan Fenimore Cooper calls them, and it is such a fitting name. Dalibarda, whose flowers seem made of white paper, and the bright green of those dear loves, the mayflowers, whose fairest flowers are found under the pines. Not the earliest, hungry and impatient, we search for those on rocky knolls, where the blossoms are small, the stems short and the leaves burnt by the hot suns to the color and consistency of brown paper. They make no haste in the dreamland under the pines.

And in the spring, where the northward turning sun shines in, the violets lift their modest faces, purple and yellow and white. The star flowers, the medeolas, the sarsaparillas, the lady's slippers, pink and yellow—of "the royal family"—windflowers and rare anemones, are some of the fair company. And though some of these will bloom in the sunlight also, yet there their growth is rank and coarse. They are slender, fragile, spiritualized, under the pines.

But where the twin-flower droops its bells, one falls on bended knee, like humblest devotee. There is no word which tells the magic power of this sweet flower—its scent elusive, rare, that fills the holy place, its modest grace; of all flowers most fair—under the pines.

The Lightest of Woods.

Deep in the bogs and swamps of southeastern Missouri, in Dunklin and Butler counties, where the land is never dry, and water from one to six feet deep stands perpetually in the forests, there grows a rare and curious tree. The natives know it as the corkwood, or cork tree.

Science has given it a longer name, the *Leitneria Floridana*, because it was first discovered in Florida, along the coast where it has long since been washed away. Some meagre specimens of it, from two to six feet high, are still found in the swamp near Apalachicola, Fla., and a few near Varner, Ark., but in both these places it is exceedingly limited in numbers, an occasional specimen being found, and hardly rises to the dignity of a tree.

Only in southeast Missouri, where it reaches the height of 15 or twenty feet and a diameter of two to five inches, is it really a tree. What makes corkwood so remarkable is its exceeding lightness. Beyond a doubt it is, as Mr. Wm. Trelease, of the Missouri Botanical Garden, has shown, the lightest tree in weight that grows.

Its wood weighs less than cork. It is so light that the natives use it to make floats for their fishing nets. And yet its wood, though so spongy one may easily sink one's finger in it, is far tougher than cork.

The specific gravity of corkwood, as learned from careful tests, made by Professor Nipher, in St. Louis, is .207. The roots are even lighter than the stem; a test showed them to have the astonishingly low specific gravity of .151.

A further idea of the lightness of corkwood may be gained by a comparison with other woods. The great majority of woods range between .400 and .800. Cork itself is .240. The tree that approaches closest to the corkwood in lightness is the golden fir tree, which grows in the swamps about Tampa Bay and along the Indian River, Florida.

Its specific gravity, according to Sargent, is .2616. In comparison with the corkwood, which is the lightest wood with its specific gravity of .207, may be placed the heaviest wood known, the black ironwood of Florida, whose specific gravity is 1.302.—*American Gardening*.

A Successful Experiment.

BY SUSY C. FOGG.

The Botanical Section of the Institute has recently introduced what I trust may prove a permanent and instructive feature in its ever-broadening scope of work.

In the latter part of May, and on July 1, successful exhibitions were held of our native wild flowers.. Both months favored an abundance of flowers and ferns, with a complete change between the two.

At the May exhibit the violet table was especially attractive, also the flowering shrubs, and so many of the commonest flowers *en masse* that it seems hardly right to discriminate. In July the various orchids and aquatic plants reached a stage of perfection.

Now, to whatever schools, institutions or communities NATURE STUDY bears a message, let us recommend this mode of popularizing the natural sciences.

Collections in any line would be instructive, but those of insects or fresh wild flowers might be more easily obtained and quite as attractive as any. The tables may be made as dainty with delicate coverings and glasses as means and time will allow, much artistic skill may be shown in the arrangement of flowers and they should be plainly labeled with common and scientific names and that of family. A good quotation or note as to habitat, whether rare, etc., adds interest.

Every year increases the appreciation of life, vegetable and animal, and we should grow reluctant to destroy that life unless we can increase it or, at least, encourage its replacement by more favorable conditions.

We must teach the boys and girls, first to *observe*, secondly to *appreciate*, and finally, to make the right use of the lesser lives over which they may have control. In what

better way could the first two results be unconsciously brought about than by two or three, more if desirable, of these attractive displays during the season.

Surely, the eager faces of the school children, bending over the tables, the interest and hearty co-operation of the teachers and the pleasure of even prominent business men who "dropped in" for an hour, and declared these flowers familiar by sight but not by name, seemed to make all trouble and weariness worth while.

Nature Study.

Prof. Bailey, of Cornell University, gives a weighty answer to the question : "What is nature study?" It is, he says, a point of view, the acquirement of sympathy with and interest in the natural world around us. We live in this world, and the better we fit it the better for us. It is for this reason that nature study deserves a place in the school studies of children. Primarily, the object of nature study is not the acquisition of mere information. Nature study is not "method" in the sense that the word is used in pedagogy. In another sense scientific method is of the very essence of nature study, it would seem. A child asks : "How old is the world? How long have men lived on it? Why has a tiger stripes? Why do certain flowers have exactly such shapes and no others?" To answer these questions the child must be made to comprehend the methods at the base of geology, zoology, botany. And in this sense it would seem that method is of the very essence of nature study.

The object of such studies is not to make the child a specialist or a scientist. It is to make him a citizen of the world he lives in—to interest him in plants and birds and insects and running brooks. The crop of scientists will take care of itself. Much is often unwisely sacrificed to a so-called "thoroughness"—which, in many cases, takes the form of a perfunctory drill in mere acts. Accuracy is, of of course, a prime requisite of all good teaching, but it is

necessary, first of all, to awaken genuine interest. The first essential is direct, discriminating, accurate observation. The next is to understand why, and the third is to want to know more. The final result should be the development of a keen personal interest in every natural object and phenomenon.—*Scientific American*.

My Wood Surprise.

BY SUSY C. FOGG.

There appeared in NATURE STUDY, Vol. I, No. 5 a sketch entitled "The Single Delight."

I, too, have occasion to speak of the little flower here mentioned, otherwise known as Moneses uniflora.

Manchester is well within the geographical range given to this plant, and it would not be rare, probably, were it not for its limited means of reproduction, but I cannot half express the pleasure of finding it, for the first time while tramping through the Shirley Hill woods in company with others.

We looked before us to the turn in the road, noted how it was walled in on either side with tall pines out of which crept fringy hemlocks, and remarked, "How beautiful!" But we were resolved to seek for deeper treasures in the wood, and turned aside.

Here was the sifting of the sunlight through the branches overhead, but not one ray penetrated to our feet beneath. The wind, which was so aggressive and unremitting on the hilltop, was not allowed to enter or breathe even a whisper. Not a voice of bird, chipmunk or running brook sounded and the footfalls were hushed in innumerable layers of pine needles. The place seemed almost stifling in its intense solitude. The tension which arises upon the occasions of birth, marriage, crime and death seems ever present in a spot like this.

The delicate coral mushrooms were pushing their way through the brown needles, and aside from these there was little plant growth, save here and there a small rosette of dark green leaves from which rose the slender scape bearing a nodding, frost white flower. These, then, were my "Delights!"

They were humble little flowers, but I gladly knelt before them, and thought of noble men and women who would not be ashamed to do likewise. We may compound the elements as we like, but the art of creation is denied us, of even a simple flower like this. What a gulf, forever, between divine and human powers!

The story was told me not long ago of an innocent child whose mind had evidently been impressed by her simple art work and, perhaps, stories of the art masters, and upon being shown a new flower, naively asked, "Whose work is this?"

Mrs. Mary J. James of Manchester, has had the pleasure of finding Moneses uniflora in several places in our vicinity. She records it for June 29, on the road to Auburn Village. Last year, she found it on the west side of the Mountain, in Goffstown, and again on Joe English Mountain.

Mrs. James further adds that she has always found it in pine land, among the pine needles and near damp places, never abundantly. Other eyes may have seen it also, but if not, it is something you will like to search for and record in NATURE STUDY.

Nature Study Lessons. III.

BY EDWARD J. BURNHAM.

The attempts to "popularize" objects in nature by inventing or applying words that are supposed to be more readily comprehended by children than the terms universally employed by scientists have been only partially successful. The multiplicity of local names inevitably causes confusion, while the absurd misconceptions which led to the adoption of many of them are best avoided by discontinuing their use. A June-bug is as likely to be found in May or July, and is not a bug anyway; May-flies are not flies at all, and one species or another may be found from March to September.

Then, too, it often happens that the so-called common term is inadequate and fails to express with even tolerable accuracy the idea which it is intended to. "Feeler," for example, is a word that has been so grievously overworked that it may mean almost anything. It is applied indiscriminately to parts of plants and of animals. It may represent, or be intended to represent, a tendril, an antenna, a palpus or a tentacle. It is possible, even, that a snake's tongue may come to be called a "feeler," when those who are now clamoring for easy words themselves know more about snakes, in which case the much-abused term will at least have been employed in its proper sense.

The truth is that we sometimes attribute to children characteristics that we have ourselves developed through inertia or sheer laziness in our maturer years. It ought to be understood and accepted as a fundamental principle that no word is disagreeably formidable to a child, except when it is unexplained or is made part of a dull task. Children at play ever delight in attempting feats beyond their strength, and this is as true of mental as of physical

effort. They rejoice in new and strange words, as in rich acquisitions to their treasure stores, and it is only after the joy of possession has been turned to bitterness by ridicule of their first attempts at pronunciation and application that they fall back upon words of one syllable as affording a possible escape from being laughed at.

The average healthy child finds a peculiar pleasure in learning the names of things, as well as facts about the things themselves, and "big words" have no terrors when the object represented is in hand, and the meaning of the one and the use of the other are in some measure understood. It is robbing the child of the pleasure as well as of the advantage in standing erect to go always on all-fours with him. It is best, therefore, in nature study, or nature play, for one blends imperceptibly with the other, to use those words which best describe the object under observation or express the idea in mind, with proper explanation, of course, but without pedantry or apology, and without thought whether they are long or short, or taken from one language or another.

It is obvious that insects are peculiarly adapted to the needs of the beginner in nature study. They abound everywhere, and are to be found in one stage of development or another at all seasons of the year. They are easily captured, and, many of them being injurious to man, the killing of them, is not generally to be regretted. Among insects, one of the best for the beginner, by reason of the distinctness of its several parts and the comparative simplicity of its structure is the grasshopper. It is most abundant in late summer and early fall, but some species or other may be found at almost any season of the year. It is captured with ease, compared with many other creatures, and the larger number that are destroyed the better it is for everybody. The parts of the body are also more distinct than in the butterflies, beetles and bees. So let us

take a wide-mouthed bottle, cut out a circular piece of paper a little larger than the bottle and make pin holes in it; place some cotton at the bottom of the bottle, pour a few draps of chloroform on the cotton, force the paper down flatly upon it, and put in the stopper. We are now ready to catch, kill and study

A GRASSHOPPER.

Watch a grasshopper awhile before trying to catch and kill it. Observe that when it moves a little way, quietly, it walks. Find one on a blade of grass or a twig, and see how it walks. Then move along in any grassy place and see them jump. Some will rise and fly, perhaps, with a snapping or crackling sound and settle down again. Grasshoppers can walk, jump and fly.

Observe that when grasshoppers fly some show red wings, some yellow wings, and others wings that are partly red, or yellow and partly brown. This color marking will help you to tell the different kinds of grasshoppers apart some day, if you care to learn what the books say about them, and to know their names.

Now catch a few grasshoppers and put them in the bottle. It is best to have some kind of a net, but every boy who goes fishing knows how to catch them with his cap, or even with his hand.

Now look a grasshopper over carefully. See that it is divided into three parts—the head, a middle part and a long round part behind. The middle part is called the thorax, and to this the legs and wings are attached. Notice that the thorax is made up of three rings, and that there are a pair of legs on each ring. There is also a pair of wings on each ring except the first, which covers the shoulders of the grasshopper like a cape. This front ring, with legs, but no wings, is called the prothorax. The long, round, hind-part of the body is the abdomen. It is made up of many

rings, but has no legs or wings. Count the rings in the abdomen in as many kinds of grasshoppers as you can find, and see if there is always the same number.

Observe the head more closely. Notice the big eyes, that cover so much of the sides of the head. With some kind of magnifier—a very simple and cheap one will do nicely—notice the fine lines crossing one another all over the eye. Two tiny eyes, like beads, can be seen in front of the compound eyes. These are simple eyes, called ocelli. With the lens hunt for another simple eye, or ocellus, on the head. Notice the antennæ, or one kind of "feelers." See where they start from the head, how long and slender they are, and that they are made up of rings. Try to count the rings in the antennæ of different kinds of grasshoppers.

Open the mouth by pressing the sides of the head. Find the upper lip and the under lip. Try to find the jaws. There are two pairs; perhaps with the lens you can find both. Notice that they move sidewise, instead of up and down, and the lower pair and the under lip have "feelers." These are called palpi, and they help the grasshopper to find and select his food.

Compare the hind legs with the front ones. How does a grasshopper jump? What keeps him from slipping? Are the hind feet turned forward or backward? Are the front feet turned the same way?

Look at the front wings. See how they overlap each other. Pull one off and see how strong and tough it is. It is called a wing cover, and is a very nicely fitting cover, too. Notice that some grasshoppers that live in very green grass have green wing-covers, while those living mostly in dry, brown fields have brown or gray wing-covers. Try to think why.

Spread a hind wing. Notice that the color pattern is different in different kinds of grasshoppers, but is always the same in the same kind. This is so that they can

know their own folks when they fly or spread their wings.

See how the hind wing folds, like a fan. At each fold is a rib. These ribs in insects' wings are called veins. Notice that they are straight, or nearly so. Grasshoppers. crickets, cockroaches and some other insects have these stright veins in their wings, and so are called Orthoptera, or the insects with straight wing-veins.

Some of the grasshoppers you catch will have four hard, sharp points at the end of the abdomen. These grasshoppers are females, and the sharp points are drills. The female grasshopper bores a hole in the ground for her eggs. She holds the sharp points tightly together and pushes them a little way into the ground. Then she spreads them and removes a little earth. She does this again and again, until she has made a hole nearly as deep as her abdomen is long. The eggs have grown in a nice, snug case. She puts this case, eggs and all, in the hole and leaves it. After a long time, usually the next spring or early summer, tiny grasshoppers hatch from the eggs, come out of the hole, and begin eating and growing.

Our Exchange Table.

The earliest miners and metal workers of whom we have record were the Aryan people of Euro-Asian origin, who, though of pastoral and arboreal habits, were familiar with the metals and worked with them—at least with the metals gold, silver and bronze. Chaldeans and Assyrians, as we know from the cuneiform inscriptions which go back 3000 B. C., were undoubtedly experts in the use of metals.—*Mineral Collector.*

Dr. William C. Prime, who has been an extensive traveller, has this to say of his favorite spot: "The grandeur

of evening in the Franconia Notch is beyond all words—nay, is beyond human ability to appreciate, There are higher mountains, deeper ravines, more precipitous cliffs in the world, but nowhere in my wanderings such lights as the departing sun leaves on the White Hills of New Hampshire. Though one has seen them a thousand times, he sees them each evening with new and sober delight, some times rising into awe."—*Among the Clouds.*

Willard N. Clute, writes in the *Fern Bulletin*: The dealers in boquets do a lively business in New Orleans in winter, for flowers are cheap and easily grown. The greenery that is mixed with the flowers, however, is not so readily produced it would seem, for a northern fern. no other than our common wood fern (*Nephrodium spinulosum intermedium*), is the principal thing used. Since this fern is not known to grow south of Tennessee, I had the curiosity to a florist and make inquiry regarding it, and was informed that the fronds are all from the New England States, being sent down by the millions in Autumn and kept in cold storage until wanted. Thus does bleak New England contribute to the enjoyment of a southern winter.

Dana W. Sweet, writing to the Journal of the Maine Ornithological Society, records an interesting incident of variation in the song of the Least Flycatcher.

"Recently while passing through the orchard at my home, where the least flycatchers are plentiful and have nests, I heard a sweet, pretty song in one of the apple trees. This seemed to be a bird that I had never heard before. I walked up quietly and as I caught sight of it, it flew upwards and began to sing an entirely different song, which sounded to me very much like the Indigo Bunting. After flying wildly about high in the air, it flew downward, and I could distinguish the notes chebec, chebec, chebec, uttered in quick succession. As it lighted in a tree near me I saw that it was a Least Flycatcher. This occurred at dusk.

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Vol. III SEPTEMBER No. 4

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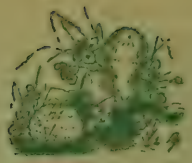

NATURE STUDY.

A monthly magazine, published under the auspices of the Manchester Institute of Arts and Sciences. EDITOR: Edward J. Burnham. ASSOCIATE EDITORS: Frederick W. Batchelder, William H. Huse, Susy C. Fogg, Theodora Richardson.

Devoted to the encouragement of the study of Nature in her varied aspects—of the Rocks, the Birds, the Flowers, and all the multitude of living things that crawl or swim, or walk or fly.

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Entered as Second Class matter at the Post Office at Manchester, N. H.

"STONE KNIVES"

In Museum of Manchester Institute of Arts and Sciences. Collected in Manchester by Mr. James O. Harriman. Scale 2-5.

NATURE STUDY.

PUBLISHED UNDER THE AUSPICES OF THE

Manchester Institute of Arts and Sciences.

VOL. III. September, 1902. NO. 4.

Indian Implements in the Museum of the Manchester Institute. III.

BY WILLIAM H. HUSE.

The stone knives in the Harriman collection are represented by the typical forms represented in the cut. The one at the left is six inches long and an inch and five-eighths wide at the widest point. It is composed of a variety of flint or chert that has the appearance of being somewha laminated. It was made by chipping, and has a fairly good edge for cutting.

The middle knife is six inches long and two inches wide. This is also flint, of a different character, and shows considerable wear. The knife at the right is porphyritic in character, and is eight inches by two. This was chipped into shape, like the other two, and has a very good edge, especially near the point.

The knife at the bottom is a semicircular slate knife, four and three-fourths inches long and nearly three inches in width. Its rounded edge shows much use as well as the soft material of which it is made. This has been considered by some as a chopping knife, but I am not aware that

we have any proof that the aborigines had knowledge of the excellences of hash.

A study of the rude implements used by the Indians, aside from the interest it excites in the comparison of curious forms, is instructive when we realize that but a short time ago the stone age, which disappeared long since in Europe, still lingered on this continent.

Voices of the Night.

BY EDWARD J. BURNHAM.

The familiar sounds of evening time in the late summer and early fall have a charm peculiarly their own. Some of them are sure to be recognized year after year, even by those who know little of the creatures that produce them, while ever and anon some half-forgotten note recalls memories and associations of childhood.

All the summer the tiny denizens of the garden, field and roadside have been feeding and growing, storing up vitality to be transmitted to the generation that is to follow; and at length, when maturity and responsibility have come, the night air thrills with their stridulation.

The most ardent entomologist must despair of learning all the notes and calling each musician by his name; but it is comparatively easy for any one to become familiar with at least a few of them, recognizing the same notes year after year, until he may truthfully say to some cricket or grasshopper that he has heard the father, grandfather and a long line of ancestors make the same plaint or sing the same song.

There is one cricket, abundant in New England, that, because of his melancholy note, may be called the pessimist of the stridulating insect tribe. He sings as if singing were vanity and vexation of spirit—as if all life were

emptiness, and it were folly to go on providing for generations of crickets that at most can amount to so little and that inevitably must pass away so soon. He is one of the largest of our crickets, and you may know him by his long wing-covers, which exceed the length of his body—an unusual exception to the prevailing cricket style. The scientists long ago named him Luctuosus, the Mournful, and he and all his species have been true to the designation. Not infrequently he will remain in one place, repeating the same world-weary note through the livelong night, no companion responding to his plaintive call, and in the morning one half expects to hear him say sadly, "I told you how it would be."

Wholly different in temperament is the Snowy Tree Cricket. His shrill, impatient notes quiver with energy. Like one conscious of a mission, he appears to be calling to all the cricket world that the raspberry canes are ready for the rows of punctures, that time is fleeting, that cold days and colder nights are coming, and that they must all be up and doing while opportunity remains. He is a prophet among his people, and, impatient of their procrastination, hastens from place to place, filling the arbor with his strident appeal.

There is a certain Long-Horned Grasshopper that is as unlike the Tree Cricket as it is possible to be. He takes his station upon some stalk of grass or spray of golden-rod, and there remains, stridulating steadily, persistently, almost sullenly, apparently indifferent to results. He does not trouble himself with vain questioning of the why and wherefore. He was formed for stridulating, and whether the expenditure of energy is worth while or not is no concern of his. One evening, with the help of a lantern, I came upon two of these sturdy stridulators. They were within three feet of each other, but went on with their steady scraping, apparently indifferent to the fact that they

were or might be rivals. Presently a female appeared and slowly approached one of them, but he did not change his position or alter his note. Not until she had mutely and patiently stroked him with her slender antennæ did he give her the slightest notice, or appear to be conscious that there was or could be any one but himself in the world.

The most weirdly fascinating of all night sounds is the call note of the song birds in their fall migration. It comes from out the darkness—sometimes anxious and inquiring, sometimes calm and reassuring, repeated again and again as the birds pass swiftly onward, until the imagination runs riot and the night air seems filled with an invisible multitude. In truth, the number must at times be great, for the calls are frequent, and it is not possible that nearly all cry out within range of our hearing, while no bird could be heard more than once by the same listener in its rapid flight.

The long, mysterious procession of the birds begins as early as the middle of August in northern New England. The bobolinks and the swallows start off first, impatient for the more abundant food of the southland. They are followed by a swelling throng, the number of migrants increasing until along in October, when it decreases until November and the bluebirds and the robins bring the migration to an end. Instinct, very likely acquired through bitter experience of ancestors long ago, impels the song birds to make their journey in the night. The hawks and kites are then at rest; the owl swoops downward only from some perch to seize his prey, and is in no way fitted to seek his victims overhead. The great highways of the air are therefore free from marauders, and the tiniest songster passes swiftly and safely on its course, protected by the darkness.

As is well known, the song birds, when the task of rear-

ing their young is ended, seek the seclusion of deep forests and dense thickets, where they cast off their summer plumage, don a traveling dress and make ready for the fall migration. Then the great southern movement begins. Each succeeding morning finds their numbers increased by travelers who have arrived from the north during the night, until at length, on an evening that promises to be favorable, they themselves set out upon a journey which, for some individuals of certain species, will end only with the southern continent, in far-away Patagonia. They travel more leisurely than do the wild geese and most other water fowl, seeking some convenient shelter at the approach of dawn, remaining in retirement or feeding cautiously during the day, and resuming their journey only under cover of the night.

By the middle of August, or the first of September at the latest, the bobolinks and the cliff swallows have left their summer homes and have taken their course southward, calling to one another in their flight. These are followed, in September, by the scarlet tanager, many of the warblers, the Baltimore oriole, the humming-bird, the kingbird, the pewee, the flycatchers and the vireos. Early in October, the thrushes, the catbird, the nighthawk and the chimney swift have left us, and by November the chewink, the brown thrasher, the phœbe, the red-winged blackbird, the bluebird and the robin have given place to the chickadees, the nuthatches, the kinglets and other winter visitors from the north.

It is rather remarkable how few of one's acquaintances have ever noticed the night call of the song birds in their fall migrations, for it is a sound which, when once listened to with attention, will never be forgotten. Coming from the upper air, and out of the darkness, it has a wonderful power to stir the imagination, and the short note, repeated at uncertain intervals, sometimes weak and timid, more

often strong and bold, combines with the stridulation of the insects to give a peculiarly distinctive character to the mild evenings of our early and middle fall.

An Aristocratic Family. IV.

BY FREDERICK W. BATCHELDER.

A still hunt for orchids is one of the most delightful experiences the true lover of nature can enjoy. The glorious uncertainty as to what he will find and where he will find it imparts piquancy to the search. There is no family of plants whose members are so irregular in their habits and consequently so elusive and so exasperating. For one thing, many of them are hard to see, though they may be within the range of vision. A green plant growing in a tangle of other green things is not easily distinguished unless its flowers are conspicuous. In some species of orchids the flowers are greenish or dull white, and many a time I have found the plants trampled under my feet when, as I supposed, I had been making the closest possible search for them, Again, if one has found a certain species in a certain section one season he naturally expects to find it in the same place the next season. He will do well not to stake much money on his expectations, for orchids have the curious habit of taking long rests. Perhaps they have made such tremendous efforts to secure cross-fertilization that they have not strength enough left to serve them through several successive seasons.

And again, notwithstanding the fact that orchids produce an enormous quantity of seeds, so that if all germinated and matured there would very soon be no room on our globe for anything else, the competition of other plants keeps them in check, and they are scarcely able to hold their own. This last fact makes them peculiarly liable to

extinction at the hands of injudicious and greedy collectors.

In the June number of NATURE STUDY I gave some account of the early orchids, with descriptions of their habitat. Those to be expected here in May are the Early Coral-root (*Corallorhiza corallorhiza*), the Stemless and Larger Yellow Lady-slippers (*Cypripedium acaule* and *hirsutum*) and Arethusa (*A. bulbosa.*) The last named is a most beautiful little plant, growing in bogs. It has a single rose-purple flower, most exquisite in hue and shape and texture. Shall I disclose its home? Never, except to a chosen few, who shall be sworn to secrecy! The species has been nearly if not quite exterminated in the best known station, and I certainly will not expose other stations to a similar fate.

Another orchid of May, a true Orchis (*O. spectabilis*), may possibly be a resident of the Merrimack basin, but I do not know that it has yet been recorded from it.

The month of June furnishes some of the showiest and most beautiful of our orchids. Early in the month blooms the Larger Purple Fringed Orchid (*Habenaria grandiflora.*) The flowers are in rather loose, large spikes, three to six inches long, which seem to light up the dark, dank nooks in the woods like so many torches. The species continues to flower in varying forms till late in August. In this locality the June form is scentless, while the form appearing later is very fragrant. Among the latter are also frequently individuals with flowers of pure white. This season has been very unfavorable to the development of the species, and for the first time in ten years I have failed to find a specimen of the later form. This is especially to be regretted at this time, for all my pressed specimens were destroyed by the fire.

Another orchid of early June is the Whorled Pogonia (*P. verticillata*), which has been found here in three sta-

tions, two in Manchester and one in Auburn. The plant has a whorl of five leaves near the top and closely resembles the Indian cucumber, for which, when not in bloom, it might easily be mistaken. The flower is more interesting than beautiful, the most marked feature being the long and narrow dark purple sepals. The home of the species is in moist woods, and one who finds it is in luck, for the plant is rather rare and local.

The Rose Pogonia (*P. ophioglossoides*)—please do not call it "Adder's Tongue"—is more common and is worth plunging through meadow and bog for. The single flower (occasionally there are two) is delicate sea-shell pink in hue and deliciously fragrant, and the lip is beautifully fringed and crested, a most tempting landing place for insects. As the plant has the habit of propagating by running rootstocks, one will usually find a good many where he finds any.

Two or three weeks later blooms the Calopogon (*C. pulchellus*), another beautiful species. Instead of a single flower, the plants bear several in a loose spike. The color of the flowers varies from light to dark purple, and the lip, instead of being pendent, as is usual in the family, is erect. The plants usually grow in localities similar to those which yield the rose pogonia but a little drier.

Late in June I have been so fortunate as to find just once the two New England species of Liparis, *L. liliifolia* in Manchester and *L. Loeselii* in Concord. Though I have visited the stations almost every year since. I have thus far been unable to find another plant. They appear to be in this vicinity rare, local and evanescent. Yet there may be hundreds of them blooming unseen in moist thickets and on springy banks. In both species there are two broad shining leaves at the base of the low scape, and at the top there is a raceme of flowers which in *L. liliifolia* are purplish and in *L. Loeselii* greenish in hue.

May and June furnish the largest number of showy and beautitul species of orchids. In July the largest number of species are at their best. Then blooms the queen of all, the Showy Lady-slipper (*Cypripedium reginæ*), extremely rare in the Merrimack valley, abundant in that of the Connecticut river. Then, too, if ever, may be found the still rarer Ram's-head Lady-slipper (*C. arietinum.*) This also I have found but once, though I have searched the vicinity of the station thoroughly many times since. Nearly a dozen species of Habenaria may be expected in this month. At the same time when the late form of the larger purple fringed orchid brings light and fragrance to the dusky woods, the smaller flowered species (*H. psychodes*) begins to bloom. This is similar to the former, but the flowers are much smaller and the spike much closer, and the fragrance of the blossoms is oppressively heavy. The plants are usually more slender than in the other species, but sometimes they are fully as large and stout, with a spike six to eight inches long, very compactly and numerously flowered.

As to the White Fringed orchid (*H. blephariglottis*) who finds it in this vicinity will be a very lucky person. There was once a station of it not far away. The "injudicious and greedy collector," aided by the ignorant flower grabber, has to all appearances completely exterminated the species there. Yet very likely the lovely spikes of pure white delicately fringed flowers are at this moment elaborating fruit along the edges of quaking bog and tangled swamp within a few miles of the city. The Ragged Orchid (*H. lacera*), being more interesting than beautiful, and having also superior adaptability to changes of environment, is comparatively abundant. The flowers are greenish yellow, or sometimes white, and the lip is beautifully fringed with long, hair-like threads. This season almost

all I have seen had white or whitish flowers. This species is one of the few which persists in cultivated areas.

In almost any wood, where leaf mold has accumulated, may be found the very plain but interesting species, *H. tridentata* (*clavellata*.) A stem a foot or more in height bears a single long leaf and one or two short ones and a terminal spike of small, greenish, sometimes whitish flowers. The most singular thing about these flowers is that although they have the usual orchidaceous appliances for cross-fertilization they are actually self-fertilized in the bud. Whether this is an instance of reversion or of incomplete development is a matter that scientists may be some day enabled to decide.

The GreenishFringed Orchid (*H. flava*) is by no means rare. It is very hard to find, however. being one of those which cannot be seen unless directly looked at. There is nothing about it to catch the eye in a side glance. But once found it is worth studying, for it is that species mentioned in the August number of NATURE STUDY as being provided with a "nasal protuberance," evolved for the special purpose of making insects approach the nectary in the proper way.

A July Bird List.

BY THEODORA RICHARDSON.

The "Bird of Rye" is of course the Hermit Thrush. It lives there, I am convinced, in every wood of any size. For after visiting "The Avenue," famed for its five o'clock Thrush Matinee, we soon found that other woods were favored by this rare songster, and the delicious melody can be heard at morning, midday (Aug. 1) and at evening in many sequestered spots.

While with us, here in Manchester, we still adhere to our old love, the "Wood Thrush," and count ourselves

fortunate to hear *him*, (for he, too, is shy.) Of course we have him next in abundance to the Veery, but we haven't the Hermit in any such numbers as at the shore.

'Tis rare there, in late July, to hear the Wood Thrush. We heard and saw only one last year at that time and none this year.

But the Hermit will not disappoint you bird lover friends, and will charm you with rare execution of his marvellously clear flute note oft repeated, but never old, until you can close your eyes, long miles away from that loved nook and dream you again hear it.

The Great Crested Flycatcher was there last year, in the same woods, but although we heard his whistle, we did not see him until this year. Then we saw the pair, and an added delight was felt when we found another member of his family in another wood somewhat distant.

The distinguishing whistle was repeatedly heard a quarter of a mile away ; and such vigor as he alike puts into song and the pursuit of insects ! This last characteristic determines his family, were it not for his crest. He loves the topmost bough of the tallest pine, and there his conspicuous crest proclaims him to his appreciative audience.

The Blue-headed Vireo was again at home in the woods, where seen a few days previously. He was flitting about in a growth of oaks, and young maples, which fringe the open meadow, beyond the evergreens.

Both these birds whistle, but the latter has the Vireo quality which distinguishes that family.

In the thicket, across the way, we could constantly hear the Veery's call note, and occasionally see him. But his full song I did not hear after July 23 this year.

As it is rather difficult to get a lengthy list of birds in July, when songs are scarce, it may be of interest to quote

those seen this year between the dates July 21 and August 1.

1. Robin.
2. Bluebird.
3. Song Sparrow.
4. Chipping Sparrow.
5. Field Sparrow.
6. Redwinged Blackbird.
7. Baltimore Oriole.
8. Bobolink.
9. Crow Blackbird.
10. Barn Swallow.
11. White Bellied Swallow.
12. American Goldfinch.
13. Purple Finch.
14. Cedar Waxwing.
15. Kingbird.
16. Phœbe.
17. Wood Pewee.
18. Chebec.
19. Great Crested Flycatcher.
20. Redstart.
21. Maryland Yellow-throat
22. Black and White Creeper.
23. Pine Warbler.
24. Black Throated Green.
25. Wilson's Thrush.
26. Hermit Thrush.
27. Indigo Bunting.
28. Chickadee.
29. Golden-crowned Kinglet.
30. Bluejay.
31. Crow.
32. Red-eyed Vireo.
33. Blue-headed Vireo.
34. Yellow-throated Vireo.
35. Brown Thrasher.
36. Black-billed Cuckoo.
37. Kingfisher.
38. Catbird.
39. Partridge or Ruffed Grouse.
40. Bob-white or Quail.
41. Herring Gull.
42. White-breasted Nuthatch.
43. Yellow Warbler or Summer Yellow Bird.
44. American Bittern.
45. Little Blue Heron.
46. Spotted Sandpiper.
47. Wilson's Snipe.

Last year the Ring-necked Plover and Scarlet Tanager were on the list ; the former were seen this year, too, but not by me.

Jack.

BY DOROTHY MAY.

In the Long Ago, when people lighted the dark winter nights with tallow candles, a candle shop stood by the side of a brook. There was a great set kettle for trying out, a heavy iron press and leaden moulds. Altogether, it was a pretty greasy place, with piles of fresh tallow leaves, great "cheeses" of scraps, barrels of prepared tallow, and boxes of candles ready for market, and the fall and winter birds evidently thought it a feast provided by the gods for their delectation.

The presiding genius of the shop—David, the Candlemaker—was an uncouth man, but he had a big heart and a warm love for the sweet things of nature, especially birds, and they seemed to know it. How they took possession and over-ran the place! For this, be it remembered, was before they were killed that women might adorn (?) themselves savage fashion with their feathers, and before the occupation of America by the British sparrow, when if one saw a bird he could be sure it was a native. There were great delightful flocks of chickadees, juncos and sparrows; hayseed was scattered for the seed-eating birds—woodpeckers, robins, nuthatches, bluejays and many rarer kinds.

There were bluejays by the brook all the year, but the summer dwellers who reared their young above the bridge went south for the winter, and it was usually a week or two before the winter residents came down from Canada, swearing at one another, as it seemed, in even rougher tones than their summer cousins, and wearing thicker feathers. But one autumn a young summer bluejay stayed; just why was never known, because no one ever got quite on speaking terms with him—whether he was

one of a belated nestfull, born out of due season and too young to take the journey, or whether he was loth to leave the flesh-pots of Egypt in the shop for the more uncertain manna of the southern wilderness, or whether, as subsequent events seemed to prove, he was unable to tear himself away from his great love, David, the Candle-maker.

Every morning he was on the great platform, where the tallow was set to cool, waiting for the door to be opened so he could come inside, and when the nights grew very frosty he stayed inside—overhead, underfoot, and into mischief generally, unless a cat, dog or stranger came in, when he retreated to the fir tree outside.

David grew very fond of his little blue-coated friend, whom he weighed down with the name of Andrew Jackson, lightened for daily use to Jack. Jack developed all the mischievous traits of his tribe, and an account of the trouble he made would fill a book. As long as he did nothing worse than to cram choice greasy scraps between the leaves of valuable papers in the little desk, or get the pen from the holder and hide it in a crack of the timbers overhead, or pull the cork from the ammonia bottle, his misdeeds were winked at, but when he took to punching holes in every candle on the top rows of the finished boxes, making them unmarketable, it was too much.

David sallied forth, and somewhere found an old cage—a very large one, that once had served as a sort of bird hotel—which he put in the house kitchen, and then, softly clapping his old hat over Jack, carried him away into captivity. He took very kindly to cage life, his only grief being separation from David, whom he greeted with screams of joy whenever he entered the room, and it made him supremely happy to perch on David's shoulder or eat from his fingers. One warm day in spring, when Jack's friends and relatives had returned from the sunny south-

land, and every feathered Jack was courting some demure little Jill, David carried the cage up to the bridge beyond the shop and opened the door. Jack came out, but no farther than his hand. Whereupon David put him on a branch and explained that while he should always be very glad to see him in the shop, he had no desire to make a prisoner of him, and he would be happier if free. Then the empty cage was carried back to the house. Less than an hour later the house mistress, having occasion to open the outside door, found poor Jack standing disconsolate on the step. He flew briskly in and onto his old cage, and there he stayed—a happy and contented bachelor.

It was entertaining to watch the play of his inherited instincts. His food—insects, nuts, bread, etc.—was never allowed to remain in a food dish, but was tucked in the cracks and crannies of his cage, under the dishes or the false bottom, anywhere, so he fancied it hidden. The house mistress soon learned to put out of reach anything like a work-basket before he was given the freedom of the room to stretch his wings. What havoc he made with a pincushion! He developed almost a parrot's power of imitation. He whistled in very human fashion. He called "Kitty," until the cat came running in, when he looked at her with a positive twinkle of fun in his eyes. Frank, the boy, could never distinguish Jack's call from his mother's. He struggled with "Dave," but even parrots can never conquer the letter V. He could say water plainly, and several other words.

Dear old Jack! He held a big, warm place in the hearts of his friends, and seemed to furnish another example of the intimate and loving relations we may establish with Nature's children if we only approach them in the right spirit.

Nature Study Lessons. IV.

BY EDWARD J. BURNHAM.

Children find a keen pleasure in details. It is not always, or commonly, a mere delight in destruction that impels a child to take his toy apart or pull a flower in pieces. There are ever so many things that he wants to know, and he takes his own way to find out. He proceeds by analysis—one of the best ways in the world, if properly directed; but he needs intelligent suggestion to enable him to perceive the significance of what he finds. Merely to pluck the petals of a flower is one thing; to discover that certain flowers always have five petals is quite another. Save for the purpose of classification, the fact is not very important of itself, but the value of the power to make such an observation cannot be over-estimated.

Most grown people see the objects about them in only a general way. The faculty of observation which they possessed in childhood, instead of being developed, has in a large measure been lost. They habitually overlook details in nature and in art. Not one in ten, scarcely one in a hundred persons, having seen a landscape or a statue, can describe it so that by the description it can be distinguished from landscapes and statues in general. They lack the faculty of taking note of details; and yet the possession or the lack of this faculty has a very practical bearing upon the conduct of human affairs. Many of the accidents and annoyances of life are directly due to want of observation, to say nothing of the pleasure to be derived from the exercise of a faculty which is so common as to be wellnigh universal among children, but which is too often lost through neglect in maturer years.

Yet this faculty of observation is easily developed and retained through exercise, and it does not matter greatly

what objects are selected for the purpose. The essential thing is that the observations shall be correct and, as far as possible, original, always bearing in mind that it is discipline that is desirable, rather than the mere accumulation of facts, however interesting the facts may be in themselves. To most people it may be of no particular consequence whether a given flower is regular in its structure or otherwise, or whether an insect has six legs or eight: but the power to observe, acquired by habitually taking notice of such things, is of practical value through life.

If, for example, we consider the common turtles of our meadows and ponds, we shall find that it matters little whether we know anything about them or not, so far as any good the knowledge can do us in the course of our ordinary affairs; and yet they possess peculiarities of structure which render them interesting objects of study, while the different species, seemingly closely resembling one another, are in reality so dissimilar that they afford an especially good opportunity for the exercise of the faculty of observation. Therefore, for this month's lesson in nature study, let us select

THE TURTLE.

Turtles abound most in warm climates, but are quite numerous as far north as New England. They can be found on almost any nature study trip by giving a little attention to hunting for them.

In moist places in the fields and meadows may be found the wood tortoise, a sober sort of turtle, of a brown or reddish brown color above, the shell having a ridge in its middle along the back. Each plate of the shell underneath has a black blotch.

In mud-holes and in small ponds, often resting on a log or stone above the water, one may almost always find the painted turtle, which has the margin of the shell marked

with red, while the shell underneath is yellow. These turtles are not so easily captured as the wood turtles, for they are rather timid and often slip into the water when approached, but with patience and ingenuity they can be outwitted at last and one secured for examination.

It is best to watch them for a time, observing their ways, before trying to catch them. Observe how they walk and how they swim. Of course they use their feet for both purposes, and they also sometimes use a fore foot to hold down their food while eating. It will be rare good fortune to find a turtle at a meal and see him hold his food, sometimes with one fore foot, sometimes with the other, but never with both at once, as cats and dogs often do.

Turtles can remain under water for a considerable time, for they are cold-blooded creatures and do not use up the air in their lungs so rapidly as warm-blooded animals do. Besides, turtles swallow air instead of breathing it, their lungs being little else than large sacs, which can be filled with air, like a bladder or toy balloon. Before diving under water, a turtle swallows a bagfull of air, and can remain until it has all been used, when he must come to the surface and swallow another bagfull. Sometime, if we dissect, or cut up and examine a turtle carefully, we shall find these bag-like lungs very curious and interesting, but for the present we are to study the outside of the animal.

After watching them for awhile, contrive to catch one. Notice how he can draw his head, feet and tail within his shell. Try to find whether he always draws his tail in on the same side of his box house. Experiment with the same turtle over and over; then sometime try other turtles in the same way, and find out for yourself whether turtles vary in this matter of hiding away their tails. This is more important than you can imagine. If all the animals and plants of the same sort were always the same, there would never be any change in the living world.

Count the toes on the fore feet and on the hind feet, noticing whether there are the same number all round. As you find other turtles, particularly in different parts of the country, if you travel about, or in such museums as you can visit, see what differences you can find in this matter of the number and arrangement of turtles' toes. It is not so silly as it may appear to some people. Notice also that some turtles have webbed feet, to enable them to swim the better.

Manage in some way to open the turtle's mouth and find whether it has teeth, or only hard and rather sharp cutting edges along the jaws.. Touch the eyes gently with a small stick, and see the turtle draw a thin skin over them. This is the third eyelid, the same as in hens, pigeons and birds generally. Notice that the feet and tail are covered with scales; then sometime examine the foot of a hen or pigeon, and see that they are scaly also. In this matter of the third eyelid and the scales the birds and the turtles have features in common. Perhaps sometime you will learn how it happened, and will find it a very interesting story.

The upper part of the shell is called the carapace, and the under part is the plastron. Examine the carapace of a turtle and see that it is covered with plates, placed closely together. Notice the row of plates along the middle, the row of plates on each side of this, and the narrower plates on the edges, which are called the marginal plates. Count all these plates in as many turtles as you can find in your walks. Notice that they differ in size, some pairs being larger and others smaller in different kinds of turtles, but that they are always the same in turtles of the same sort or species.

When you find a wood turtle, notice that the plates on the carapace have black lines which are said to radiate—that is, extend from the center towards the edge of each

plate. They also have very fine lines, called striæ, which form more or less regular rings around a common center. It is because of these lines and delicate rings that scientists have named this turtle insculptus—which is Latin for engraved or carved. The under shell or plastron is also composed of plates, which are always in pairs. Count them, and learn to compare the size of each pair in the different species that you find. The scientific name of the wood turtle is *Klemmys insculptus*—klemmys being a Greek word meaning tortoise.

Compare a painted turtle with the wood tortoise. Notice that each plate is greenish black, but paler at the edges. This gives the appearance of light-colored stripes running lengthwise and crosswise between the plates. The marginal plates are splashed with bright red, and the under shell is yellow. Sometimes the plates of the plastron, or under shell, are blotched with brown. The light-colored stripes, the bright red splashes, the yellow plastron and the brown blotches give this turtle the appearance of being painted, hence its common name. Its scientific name is *Chrysemys picta*—from a Greek word meaning gold and a Latin word meaning painted.

There are several other species of turtles in New England, and west and south many more ; but this is already a long lesson. Perhaps it will help to show that the harmless, clumsy turtle is really an interesting creature and deserving of more attention than it commonly receives, even from people who find pleasure in learning about the living things in our woods and fields and ponds and streams.

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Vol. III OCTOBER No. 5

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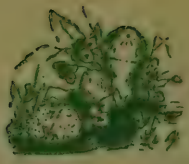

NATURE STUDY.

A monthly magazine, published under the auspices of the Manchester Institute of Arts and Sciences. EDITOR: Edward J. Burnham. ASSOCIATE EDITORS: Frederick W. Batchelder, William H. Huse, Susy C. Fogg, Theodora Richardson.

Devoted to the encouragement of the study of Nature in her varied aspects—of the Rocks, the Birds, the Flowers, and all the multitude of living things that crawl or swim, or walk or fly.

Terms: 50 Cents per Annum in Advance.

Advertisements, not to encroach upon reading matter, will be published at a uniform rate of 25 cents an inch for each insertion, without reference to number of insertions or amount of space taken; but no advertisement can be accepted for less than the price of a single inch, one insertion.

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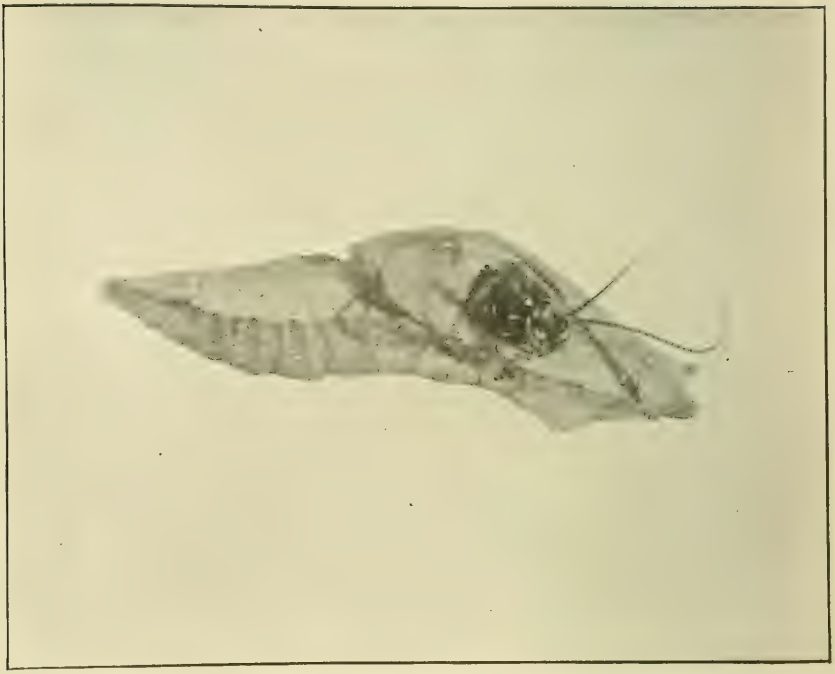

INFESTED CHRYSALIS OF PAPILIO POLYXENES.

Photographed by E. H. FOGG.

NATURE STUDY.

PUBLISHED UNDER THE AUSPICES OF THE

Manchester Institute of Arts and Sciences.

VOL. III. October, 1902. No. 5.

A Common Tragedy.

BY WALTER S. ABBOTT.

In the accompanying picture is shown what appears to be a case of very righteous judgment, sent upon an evil-doer. The chrysalis is that of the larva of the Black Swallow-Tail (*Papilio polyxenes*), and the evil-doer is one of the larger ichneumon-flies — probably of the genus Ophion.

Sometime last fall a specimen of the larva of this butterfly was found, placed in a breeding cage and fed, with the expectation that in the spring a butterfly would emerge, to be mounted and placed in the collection of the Manchester Institute. But "man proposes," etc., and never was shown more clearly the force of the old injunction, slightly modified, "Don't count your butterflies before they are hatched." For, instead of a beautiful butterfly with velvety black wings, there appeared what is seen in the picture.

Although at first it might seem as if there were some magic in this change from a butterfly to this creature, whose head can be seen protruding from the side of the

chrysalis, it is really nothing remarkable, but merely one tragic act in that terrible struggle for existence that is continually going on all around us.

Had we been present at the first act of this tragedy, we should have observed, sometime before the larva was captured, a scene something like this: The caterpillar would have been seen feeding quietly upon the wild caraway, the parsnip, or some allied plant, totally unconscious of any danger, while hovering near it we should have noticed another insect, measuring an inch or an inch and a half in length, and of a light yellowish brown color, looking as much like an over-grown hornet with an extremely long abdomen as anything.

By and bye, this insect would dart down and, with its sharp ovipositor, place an egg in the body of the caterpillar, and then depart in search of another victim. The larva, apparently not at all injured, would continue eating, and it was at this time that it was captured.

In due time the caterpillar ceased to eat, and, hanging itself from the top of the cage, formed the customary angular pupa, suspended by the tail, and supported by the silken girdle around the middle.

But now comes the time when the offspring of the ichneumon-fly does his deadly work. The egg, soon after it had been laid upon the daterpillar, hatched, and the larva bored its way into the body of its unwilling host, and now has been steadily eating away until nothing remains but the hard outside shell of the chrysalis, and the larva of the ichneumon has become a pupa, waiting for the time when it shall burst forth a full-fledged hymenopteron.

As usual, the insect matured and attempted to force its way out of the shell of the chrysalis, but it did not succeed. Either the temperature of the room was too high, or the air too dry, or perhaps you would prefer to call it a just punishment sent upon the guilty. At any rate, the

ichneumon died after getting his head and thorax out of the chrysalis, and remains as seen in the picture to tell of the double tragedy of the butterfly and its enemy.

An Owlglass Trick.

BY A PINFEATHER ORNITHOLOGIST.

Twenty-two years ago a kind but misguided friend gave me a stuffed horned owl, hideously mounted on a round stick. "Minerva's bird, and typical of wisdom; a suitable ornament for the top of your bookcase, my dear," she said, "so take it with my love."

For the sake of the love, and not at all for Minerva's, I have kept the owl, and daily dusted him with varying tides of appreciation, which never reached their flood, I fear. I have often looked for moths in his plumage, but there they never came, preferring my furs and ostrich feathers. Had he been moth-eaten, I could surely have buried him with a good conscience in the rubbish barrel. As I was today for the 7965th time giving him his daily rub with the duster, I said to myself, "What on earth are you keeping this stuffed relic here for, Pin Feather?" Why not unperch him, and carry him into the woods with you? Set him up in a life-like attitude on a branch, and sit you down in the near-by scrub to watch."

In an hour we were both actually placed as I had fancied. Minerva's bird, his feet once more clutching a real branch in a forest, looked so life-like that it seemed as though this contact must really have thrilled his cotton and arsenic "insides." Myself, Turk fashion on the ground under a neighboring tree, I waited. Nothing happened. Not a chirp was heard in any direction. It seemed fearfully still to a woman alone in a gloomy forest of tall

pines. I wondered when my anticipated fun in fooling the birds was coming.

This was uncanny. Did I hear an owl hooting? No. I began to wish that my owl would turn his head a little; then to fancy that he did. Then I grew irritated because he stared so. Horrid, wide-eyed creature! How had I ever endured his stuffed pomposity so many years on my bookshelves? I would go off and leave him here in the woods, and hope Minerva would come to look after her own. I would have no more of him. Then a chirp; next a twitter, and I was entirely the hopeful bird-lover again, with interest and affection for even stuffed specimens. One chickadee said to his mate:

"My gracious! Will you look at that!"

"What?"

"Come quickly and see this great horned owl."

"Children, this is the great fellow that pounces on you in the dark, as you sleep on your perch, and crushes you, and eats you, bones, feathers and all. Look out! Beware!"

And down the whole family came to a safe distance in an opposite tree, calling loudly as they hopped over the spiral stairs. Then in wildest curiosity they flew to his tree, daring even to descend to his level, seeing it was daylight. Now came more birds, attracted by the unusual noise. These chattered and called and swelled the chorus. Soon four or five were flying around his head, and perching within three feet of him, but not below. Then a soft breeze came and ruffled the owl's feathers, making him look so ready to pounce that with hysterical chatterings the more venturesome whirled to a safer retreat.

By this time surely twenty-five chickadees were in the wildest state of excitement. With them two black and white creepers, a pair of unexcitable Nashville warblers,

and one slow, plodding nuthatch. By and bye a mature and a baby black-throated green warbler.

"Not so very horrible, after all," these said. "That chickadee tribe always was emotional, and quite too brawling and excitable at such times for reputable birds of our reticent equilibrium."

So they all flew off, leaving the chickadees to settle with the bird-eating intruder if they wished. After satisfying their curiosity and teaching the children that here was a Horror, not only to be avoided but to be proclaimed abroad, these, too, flew away. No doubt each adult bird had the idea that though his young were old enough to fly from the Terror, he had wisely warned the cedar birds and goldfinches, whose children had hardly left the nest, that they must keep still that night, for owls were around.

The forest was now deserted, left to the dead owl, the dead stillness, and to me.

Taking his majesty down from his perch, I brought him home. The drive to the woods in company with the botany box and the lunch basket had spoiled his ancient beauty. With one horn cocked forward over an eye, his tail-feathers broken, his breast plumage rumpled, dethroned, unkempt and disreputable, he now hangs in a dark closet by one leg. When spring comes, and the breeding season is on, he shall emerge from his darkness and be once more taken to the wood, there to be perched in mock dignity and awfulness on a tree. Then, with young nestlings to protect, I'll see if I can't make the phlegmatic nuthatches and Nashvilles scold, warn, and flutter about the offending bird, who shall sit just in the range of my opera-glass.

Every month again has its own charms and beauty. We sit quietly at home and Nature decks herself out for us.—Sir John Lubbock.

An Aristocratic Family. V.

BY FREDERICK W. BATCHELDER.

In the last article I suggested that a species of the true Orchis, *O. spectabilis*, might possibly be a resident of the Merrimack basin. Since that was written I have been informed on good authority that the species has been found in Holderness. Having as yet no specimen as a voucher, I am not prepared to claim it as a resident even of the valley of the Pemigewasset river, which is a tributary of the Merrimack.

As one mission of NATURE STUDY is to elicit and diffuse information concerning our native flora, I take this opportunity to ask any persons who may know that the above-named species has been found in New Hampshire east of the Connecticut valley to communicate with the editors, and, if possible, furnish specimens, with notes of date of collection, locality, the collector's name, and such other facts as may be of interest. Notes unaccompanied by specimens as vouchers are of very little use for scientific purposes. In this matter botanists have the advantage of ornithologists. A rare plant may be taken without dog or gun, and, at present, without transgressing any statutes except, possibly, those enacted for the protection of private property.

Continuing the July list of orchids in flower, I come next to two species of Habenaria which are quite different in habit from the rest of the genus. The most of these have a leafy stem. The two under consideration have only two root-leaves, which are large and nearly round, and a scape which bears a spike-like raceme of flowers. In *H. orbiculata* the flowers are greenish white and have rather long, spreading pedicels; in *H. Hookeriana* they are yellowish green and have shorter, erect pedicels. The

leaves in both species are shining above and silvery beneath.

In swamps and damp woods, often growing alongside decaying logs, may be found the tiny *Microstylis ophioglossoides*, a plant scarcely as long as its name, but nevertheless very interesting. It looks very much like the small false Solomon's seal. There is but one leaf, the shape of which has given the plant the disagreeable name of "adder's-mouth. The greenish flowers are minute and are arranged in a terminal raceme, which is obtuse at the apex. In *M. ophioglossoides* the leaf is near the middle of the stem—in *M. monophyllos* it clasps the base of the stem.

Two species of coral-root may be found in July, *C. odontorhiza* being at its best then, and *C. multiflora* just beginning to bloom. The former species is, so far as my knowledge goes, very rare in this vicinity. I have found but one plant, and that was so completely used up in the examination that it was not available for an herbarium specimen. The latter species is common in dryish woods, especially in leaf-mold, and continues to flower till September. The scapes are purplish or yellowish, or sometimes clear yellow. These latter, however, turn purplish in drying. The coral-roots are of all our orchids perhaps the nearest to being true saprophytes, deriving their sustenance from decaying vegetable matter. [See NATURE STUDY, Vol. II, No. 6. November.]

The genus Goodyera (Peramium) comprises the orchids popularly known as "rattlesnake plantains." Until quite recently ours have been divided into two species, *G. repens* and *G. pubescens*. Concerning the latter there is no question. It is that species which blooms in dry woods through July and August. The root-leaves are light green in hue and strongly reticulated with white. The scape bears a spike of greenish white flowers which is neither one-sided nor spiral. The plants have been particularly handsome

this season, and so full of moisture that it took two weeks to dry specimens sufficiently to prepare them for the herbarium. As to *G. repens*, that species is common to Europe, Asia and America. It has recently been discovered that most of our Goodyeras which have gone by that specific name are not identical with it, and already two well-defined species have been separated, *G. ophiodes* and *G. tessalata*, the former blooming in cold mossy woods from July till September, the latter in woods in the month of August. The plants are usually smaller and the leaves darker green than those of *G. pubescens*. *G. ophioides* is described as having a one-sided and *G. tesselata* a spiral spike. I am not yet prepared to say to which of these newly named species our local plants which are not *G. pubescens* belong. It will be in order for observers and collectors to make careful notes and prepare good specimens with a view to forwarding the settlement of the genus.

Several of the orchids which are at their best in July, or which begin to flower in that month, keep on blooming through August, and even into September. The orchid which may be called peculiar to August is the very rare *Pogonia pendula* (*trianthophora*). This was so fully described among the "symbiots" in NATURE STUDY, Vol. II, No. 10, March, that I will not here enter into particulars, It is a fairy flower, growing in leaf-mold, and partially dependent for its subsistence upon the co-operation of certain fungi. The popular name, "three birds," is very appropriate, since usually about three of the dainty flowers are produced on a plant. I have found the species only at Meredith, where it grows in a beech wood, in the leaf-strewn hollows between the rocks, where an underground rill runs down the shaded slope to the lake.

There remains but one more genus, Spiranthes (Gyrostachys), "ladies' tresses," of which I can at present name but two as resident in this vicinity, *S. gracilis* and *cernua*,

the latter being the very last of our orchids to bloom. *S. gracilis* is the one with root-leaves small or wanting, which blooms in grassy places in August and September. The delicate white or greenish flowers are arranged in a slender spike which is apparently spiral, from the twisting of the axis, and they are most deliciously fragrant. About the last of August *S. Cernua* begins to bloom, and the cheery spikes may be seen in September and October, long after the frosts have killed the more sensitive plants. An appropriate name is that by which it goes in country places, "frost flower." The plants have long grass-like leaves and a rather stout many-flowered spike, which is more or less twisted in different individuals. According to the manuals, the species in this genus are divided into two groups, those with three-ranked and those with two-ranked spikes. *S. cernua* is placed in the three-ranked group. This described character was the cause of some embarrassment to me in my early days of botanical study, for I very soon found plants in which the spikes were evidently not three-ranked. The inference was natural that these plants belonged to some other species. The other characters, however, fitted no description but that of *S. cernua*. Any one who will take pains to examine these plants will find the form of inflorescence various, sometimes three-ranked, sometimes apparently one-ranked, at any rate, not three-ranked. As to the spike, sometimes it is straight, sometimes twisted, and most twisted when the flowers are apparently in one rank. I hope in some future article to treat of this subject more fully.

With the close of this series of articles on "An Aristocratic Family" closes also the orchid season of 1902. With the object of stimulating observation and discovery next season, when these uncanny plants shall again lay their schemes for enslaving the insect tribes and thus se-

curing the great end of orchid existence, cross-fertilization, I will name certain species which should be specially looked for, or which, if already known as resident in the Merrimack basin in New Hampshre, should be reported and added to the local flora. Let me also again emphasize the importance of notes or accounts being accompanied with specimens as vouchers.

LIST OF LOCAL DISIDERATA.

Cypripedium parviflorum, Smaller Yellow Lady-Slipper.
Orchis spectabilis, Showy Orchis. (Already reported from Holderness.)
Habenaria bracteata.
" dilatata.
" obtusata.
Listeria cordata.
Microstylus monophyllos.
Goodyera ophioides, as differentiated from G. repens.
" tessellata " " " "
Spiranthes (Gyrostachys) simplex.
" " ochroleuca (a variety S. cernua?)
" " plantaginea (latifolia.)
" " Romanzoffiana. (Reported this season from Franklin.)

There are a few other possibilities, but this list, I think, includes all the probable finds.

THE MUSKALLUNGE.

Whence and what are you, monster grim and great?
Sometimes we think you are a "Syndicate,"
For if our quaint cartoonists be but just
You have some features of the modern "Trust."
A wide, ferocious and rapacious jaw,
A vast, insatiate and expansive craw;
And, like the "Trust," your chiefest aim and wish
Was to combine in one all smaller fish,
And all the lesser fry succumbed to fate,
Whom you determined to consolidate.

—Wilcox.

A Misty Morning's Find.

BY THEODORA RICHARDSON.

"But all sorts of wind and weather
Must be taken in together
To make up a year,
And a sphere."

—Emerson.

This thought was uppermost in mind when the enthusiastic bird lover started off at half after five on a misty July morning at Rye.

That sleepy calm rests all around; no vehicles, no voices, no gongs, the song of birds, and muffled roar of ocean are the only noticeable sounds. Only the near high green bank bordering the sands, and the rocks, a little beyond, bordering the low tide are to be seen. Old ocean is obscured in a misty shroud.

But for cheer there is the delicious strong sea-odor, and a slight breeze just springing up gives promise of a change of weather.

Wheeling away, our first bird-notes are those of the goldfinches flying overhead in the still, peaceful air, singing as they fly. How care-free they always seem in their yellow coats! Turning to the right the road conforms to the ocean's curve; an expanse of marsh, with intermingling alder growth, meets the eye. Each grass blade is bending low with its diamond dew-drop. The rabbit-foot clover looks even more furry with its downy grey head enveloped in mist. The daisy-like flowers of the camomile are opening at the slight suggestion of light, and clover leaves are unfolding.

How intense the pink of the wild roses, lasting for an unparalleled time, as have the cultivated roses this year. In a clump of willows on our left, the catbird begins his early questioning, as we ride by. The Wilson's thrushes are

calling back and forth, from thicket to thicket, now on this side and now on that, occasionally the note is varied by the full song.

The road winds by the great hotel, now silent. In front of it are stretches of beautiful green lawns through which are well kept drives. The incoming tide as it dashes on the ledgy shore is viewed through a vista made by a long line of immense willows.

There is a flicker! Did you catch the golden gleam of his wings? And get a glimpse of the white rump? There is the mate in hot pursuit. Above the broad green lawn they fly, past their former home in that stately willow, they disappear from view in the oak woods.

The never failing song of the cheery song sparrow rings out full and clear. At any time of day you can see the dear little bird with spotted breast perched on the stone wall. How it throws its little head back and sings for pure joy never heeding the mist, always in good spirits! An an swering call to its happy trill comes simultaneously from several directions.

There are some spotted sandpipers, running among the rocks, uttering their sweet, clear whistle. The small flock rises, still whistling, and, wheeling, they fly seaward, and are soon lost in the mist.

We lose sight of the sea, as we follow the winding road under the shadow of the high, pebbly embankment. On this embankment we surprise a flicker in company with several robins. What are they doing there? Eating insect life?

The beauty of the salt marsh now appeals to us in its varied coloring. The tall, stiff grasses, with brown, fruited heads, growing in towering tufts amid the generally even mass of billowy, dark, green grass, now swaying in the freshening breeze, so graceful, although so coarse; next the woods, this green is toned into a soft, purplish red line

of color; and next the sluggish run a dark Indian red makes a mirrored reflection, with mixture of dull, yellow green of low-growing herbs.

The woodland outline is unbroken, save by the seaward course of the winding brook. Across the marsh a flock of red-winged blackbirds wing their way. On the trolley-wire are clean vested kingbirds.

From that vantage point they make frequent sallies for their insect prey, returning to nearly the same point. Their heads are in constant motion, now looking up, now down, and sometimes almost back of themselves, until you wonder what keeps them from losing their balance. A pair of bluebirds glint by, warbling softly to each other.

We leave our wheels and turn away from the highway, following the car track, a short cut to the woods. A bobolink, with his family of five soberly dressed companions, hurries away from the marsh toward the adjoining orchard, The breeze wafts bits of his song to us, reminding us of in land orchards where he sings earlier in the season. But a surprise awaits us at this point.

What is this great, ungainly, gray-brown bird, with long yellow legs, and long neck crooked up in flight? A marvellous flight, without noise, and with apparent ease, the American bittern wings a straight course to the woods. While looking and wondering at our good fortune to get such a near view of this bird, and to have a new bird to add to our summer list, a second, with telling, leisurely stroke, follows the course of the first.

But surely there are no more? Alert, with interest and much caution, we creep up to the bank of the little run, and there is a third. With head erect, motionless, in the tall grass he is hardly discernable. But he has already thought of flight, for he has listened to the warning cry of his retreating friend, so he, too, withdraws from our astonished gaze, crossing the marsh like his predecessors.

His great primaries spread apart in flight much as those of a crow. The great cloud-like shadow of his large bulky frame is reflected in the tiny stream, as he sails overhead. A hardly audible expression of delight is enough to startle another long legged beauty from a concealed grassy nook, quite near the bittern's locality.

This denizen of the swamp, the fourth great bird of the morning, rises slowly, taking the opposite direction from his associates, in solitary flight. He is not the great blue heron for he is so much smaller than the bittern. His legs are decidedly yellow, and his back is a very clear blue, we conclude we have seen an immature little blue heron.

On the miniature pebbly beach, where the flow of the brook is quickened, we get a glimpse of what appears to be Wilson's plover. But the exit of the large birds is a signal for their departure. They leave their breakfast among the pebbles, and whirl away like a flurry of autumn leaves. Already feeling convinced that the misty morning is the morning for sights, we push on toward the woods.

Arriving at the edge of the spruce growth a pair of brown thrashers silently hop across the brown road, disappearing in a low white pine. The sun is trying to pierce the clouds. Bunny is out in the road. Whatever his mission, he is now immovable, thinking in this manner to escape detection. He is such a wee, woodland baby. Now he sees his mother run, we are too near, so fear lends speed to his legs, and his tail shows the white feather, as he bounds away in the cool depths of the undergrowth,

The fence wires are momentarily occupied in succession by bluebirds and kingbirds. A large number of flickers inhabit this wood, their cries awakening the echoes as they call from distant treetops to one another. The woods resound with the jays' noisy cries, whose jargon vies with that of the crows.

A lull of sound drawing our attention to a blue cone-laden

spruce, bathed and dripping with sparkling mist, we discover four golden crowned kinglets; flitting about, talking to each other, they shake down the hanging drops by their constant activity. A flock of these tiny birds not seen in Manchester woods since January, but here seen in July! Very thoroughly they go over the whole tree, giving little attention to us. Returning another day we find them in the same woods.

The ever restless chickadees are in company in adjoining evergreens. A female Maryland yellow-throat appears, looking somewhat bedraggled but in good spirits, for over by the brook her little black masked husband is giving his resonant call

The shady path brings us to a barrier—a high rail fence. Having climbed the fence we enter the Cathedral woods. We appreciate this woodland Cathedral the more from the fact of the difficult access. A brown, pine-needle carpet covers the floor, deadening the sound of footfalls, bidding the senses drink in the solemn grandeur. Overhead the green boughs meet in protecting majesty, giving glimpses of the grey and blue frieze of the sky. The brown tree trunks let in the slanting rays of early morning light.

The weird, long loved trill of the Wilson's Thrush appeals us to with renewed beauty and neither detracts or adds to the entirely different, but peculiar, charm of the high clear leisurely note of the hermit. The trill emanates and pervades the place with its rolling cadences of beauty.

Equally pleasing are the exquisite modulations of the strains of the shyer cousin of woodland solitude, for however remarkable yet distinctly characteristic each song may be, with equal charm it appeals to me, and does not suffer by comparison in forest depths.

Here let us rest content, and look and listen. Gradually brightening, the slanting sun's rays pierce the gloom, and glorify the beautiful whole.

Nature Study Lessons. V.

BY EDWARD J. BURNHAM.

An incidental but important result of nature study is the brushing away of prejudice against many harmless and inoffensive forms of life. In this way, as in so many others. it tends to increase the sum of human happiness. Many a person otherwise intelligent and sensible, finds the pleasure of a ramble diminished or destroyed by a dread of creatures that are not only powerless to inflict injury, but whose habits are interesting and whose lives are useful. Many a sheltered nook, teeming with life, and full of pleasing possibilities, is shunned because of fear that some object of dread may be discovered there.

The truth is that in temperate climates there are very few animals or plants that call for the exercise of more than ordinary caution, while the vast majority of both are harmless altogether. There are certain degraded parasitic forms that may properly be despised; certain others excite disgust by their modes of existence, and a somewhat larger number may inflict temporary pain if carelessly handled; but as knowledge increases, fear is supplanted by reason, and prejudice disappears. Toads. lizards and snakes, for example, are almost universally regarded with sensations of disgust or fear, and yet, a little time devoted to the observation of their habits will modify one and allay the other. No person of ordinary sensibility can long contemplate any one of our common harmless snakes, as it goes on its narrow round of existence, without finding prejudice change to pity for the half-blind thing, feeling its way with its tongue, doomed to kill that it may live, and almost certain to be killed in its turn by some creature as hungry as itself. For all life in the fields is sooner or later a tragedy.

With the possible exception of snakes, there are no ob-

jects in nature against which prejudice is stronger and more deep-seated than against spiders. It was generally believed in times past that spider bites cause lameness, insanity and even death. The belief is still well nigh universal that the bite of the spider is poisonous and capable of producing serious results. But as a matter of fact, very few species of spiders can bite human beings at all. Most species are unable to open their mandibles sufficiently to gain a hold upon the skin. Bertkau allowed spiders to bite his hand. On the ends of the fingers the skin was too thick, but between the fingers they easily pricked it. The bite swelled and smarted for a quarter of an hour, then itched for some time, and for a few days itched whenever rubbed, as mosquito bites will. Blackwell made several large ones bite his arm, and at the same time pricked himself with a needle. The results were the same ; no inflamation or pain followed in either case. I have myself handled many spiders ; have been bitten but once, and then could detect no results whatever. The dread of spiders, evidently, rests upon ignorance and prejudice.

But spiders, even if one dislikes to touch them, have interesting habits ; many of them weave curious webs, and all are useful to men, by reason of their destruction of insect life. It is wise and profitable, therefore, in walks afield, to give some attention to

THE SPIDERS.

Spiders may be found at any season of the year and in all sorts of places ; in the winter in houses and sheds, under stones and the bark of trees ; in summer on shrubbery, on fences, on the grass, and even in the water, among the lilies, in tiny diving bells of silk. Some weave elaborate and beautiful webs, some weave rude and shapeless nets ; some make mere tubes in which to hide ; some dig holes in the ground and line them with silk ; and many, as the jump-

ing spiders and crab spiders, do not weave any web at all.

With a simple pocket lens the larger spiders may be studied easily. There are eight legs, and a pair of "feelers" or palpi, that look like legs. The legs are seven-jointed, and in some spiders each foot has three claws; in others the foot has two claws and a brush of hairs. The legs are attached to the front half of the body beneath, while on top, farther in front, are the eight bead-like eyes. These vary in size and arrangement in different kinds of spiders, and it is an excellent nature study exercise to make drawings, showing the eyes by means of small and large dots in straight lines and curves, just as they are arranged on the head, with the corresponding web sketched on the same page.

Below the eyes, in front are the strong mandibles, with sharp points that close against the inner side of the mandibles, like the blade of a jacknife, and open when the mandibles are spread apart. It is because the mandibles can open but a little way that most spiders are unable to bite large objects. The spider holds small insects in these mandibles and chews with another pair of jaws, swallowing only the juices, sometimes chewing for hours on a single fly, until the skin and legs and wings are rolled into a little ball, which some spiders have the curious habit of hanging up in their webs, as Indians used to hang up scalps on their wigwams.

At the rear of the abdomen are the spinning tubes, or spinnerets, which, in many spiders, can be seen with the naked eye. When a spider would spin, it presses these spinnerets against some hard object and then walks away, drawing out the thread as it moves along and holding it up with its hind feet.

If one does not like to study spiders, there is still sure to be an interest in the webs, and there are so many kinds, in so many places, that there will always be something new

to be found and examined. The house spider offers a pretty study for a rainy day. Its web may be found in the cellar, stairways, under furniture, in rooms not used, or perhaps in the living room itself, if the maid has been a little careless. It is an irregular web, with threads crossing in all directions, and held in place by other threads above and below. There is usually a thicker portion, like a tent, at the top, under which the spider stays, always up side down when at rest. These webs collect large quantities of dust if left alone, and are known to every housekeeper as cobwebs. The little spider that makes them is called *Theridion vulgare*, the common theridion.

On damp mornings in summer the fields and lawns are seen half covered with flat webs. These remain on the grass all the time, but are visible at a distance only when the dew is on them. The flat part, which may be from an inch or two to a foot across, consists of strong threads, stretched from one stalk or blade of grass to another, and crossed and filled in with finer threads. The web is woven so close and stretched so tight that one can hear the footsteps of the spider as she runs upon it.

Watch and listen patiently a long time, and while doing so, notice the silken tube at one side of the web, leading down among the grass-stems. The spider, when her web is complete, usually stands at the top of this tube, just out of sight, and waits for something to light on the web, when, if it is small, she runs out, snatches it, and carries it into the tube to eat. If something too large comes to the web, the spider retreats down the tube and goes away. Mr. Emerton says that when this happens the spider can seldom be found afterwards.

At the edge of woods and beside small brooks, sometimes stretched across them, one may find the large round web of Epeira, the orb-weaver. This is the most beautiful of all the webs which spiders weave. The Greeks explained

its regularity and beauty in their own way. A maiden named Arachne had been taught to weave by Minerva, and grew to be so vain of her skill that she foolishly boasted that she could excel her teacher. This angered the goddess, who in revenge changed Arachne to a spider and condemned her to go on always spinning the beautiful webs that we may see to this day. It is rather a cruel story of a little girl's silly pride and a goddess' more silly jealousy, and perhaps the best thing about it is that it is not true.

There several species of Epeira. The individuals, when grown, are mostly large, all are beautifully marked, and all are harmless. The webs are all made on the same general plan, with strong threads stretching out quite regularly from the center, like the spokes of a wheel, and with another thread winding spirally round and round from the center to the outer edge, or circumference. But each species has its own peculiar way of hiding and resting while waiting for something to happen. Some hide at the edge of the web, under a leaf of the bush to which the web is attached ; some weave a circular mat in the center of the web, and others make a beautiful staircase of white silk, running zigzag downward from the center of the web, on which they rest patiently for hours and hours.

There are many other kinds of spiders, and many styles of webs, but enough of interest has already been suggested to keep a nature study class wide awake on many a walk afield.

The universe is so admirably fitted to our organization that the eye wanders and reposes at the same time. On either side there is something to soothe and refresh the sense.—Thoreau.

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Vol. III NOVEMBER No. 6

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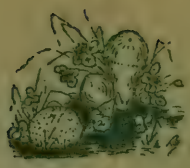

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A monthly magazine, published under the auspices of the Manchester Institute of Arts and Sciences. EDITOR: Edward J. Burnham. ASSOCIATE EDITORS: Frederick W. Batchelder, William H. Huse, Susy C. Fogg, Theodora Richardson.

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SCALE 3-7.

NATURE STUDY.

PUBLISHED UNDER THE AUSPICES OF THE

Manchester Institute of Arts and Sciences.

VOL. III. November, 1902. No. 6.

Indian Implements in the Museum of the Manchester Institute. IV.

BY WILLIAM H. HUSE.

The implements of the stone age were necessarily rude. Made of such refractory material and by means of equally refractory tools the wonder is that they were as efficient as they prooved to be. With spear and arrow points, axes, knives and celts of stone, the Indian had about all he needed for the necessities of life. His superstition, love of ease, and the beautiful and other qualities of mind, however, demanded other things. He wore pendants as charms and ornaments and these must have holes. The red man was addicted to the weed and needed a pipe of suitable materials.

In making these he used drills of the only material at his command and found them serviceable.

The thirteen drills shown in the cut were all, except the one in the center, picked up near Amoskeag Falls by Mr. Harriman. It is possible that two or three of them may be unfinished arrow points, but evidences of wear make it probable that they are completed implements.

The materials of which they are composed are as varied as those of the other artifacts found in this vicinity, and adds to the probability that the Indian village at Amoskeag Falls was a mart where such goods as the aborigines used and traded were brought here for barter. One of the larger drills is quartzite, several are composed of varieties of flint or chert; the others are made of the harder igneous rocks, red and black.

Of the largest five represented, at least two must have been used considerably, for evidences of wear are plain. Some of the smaller ones are also worn. The latter were used in perforating the various pendants and charm stones and whenever small holes were required, the former might have been used in making the bowls of pipes in whatever rock was soft enough for the purpose.

Wings.

BY DOROTHY MAY.

"Wings! wings! to sweep
O'er mountain high and valley deep.
Wings! that my heart may rest
In the radiant morning's breast."

—Ruckert.

It is the instinctive longing, the universal cry of all animate nature, to rise, to fly! But of all the myriad forms of life, to birds alone has it been vouchsafed by the Creator "to sweep o'er mountain high and and valley deep," and the weakest bird having wings can look down with contempt on the king of beasts without them. The lowest forms of bird life, in which the wings are rudimentary, represented by the penguins, can scarcely be called birds. In them, Nature appears to be undecided whether to make a bird or a fish, and indeed their suggested wings act somewhat as

fins to help oar their way through the water where they seem in their natural element. But rising in the scale by gentle gradations through the ostrich, whose great wings, though unable to lift the heavy body, are yet the sails which help it skim with such swiftness over the sand oceans of the desert, and the unwieldy domestic fowl, we come to the grouse and its kindred, which with their power of flight, heavy and labored though it be, brings us toward the typical bird of the air.

What a marvel of construction is a perfect wing. Like a human arm and hand, even to suggested fingers, linked with powerful muscles to the body, with the barbs of the overlapping feathers hooking together when the wing is spread with hooks of microscopic fineness, making an almost air proof surface.

Of various shapes, but always perfectly adapted to the special use required of it. Short and wide in birds which spend much of their life on the ground as game birds etc., growing longer and more slender in the birds of the branches, until a swallow's wing cuts the air like a scimitar. But after all, the chief source of a bird's power of flight, without which even the wonderful wing would be useless, lies in the air sacs under the skin and in the hollow bones by means of which a bird may render itself light or heavy at pleasure by admitting or expelling the air. And here it is that our bungling human attempts at flying have failed. From fabled Icarus down, we have tried only to construct the wing, forgetting the hidden, but more important, air reservoirs, though Santos Dumont is coming nearer the true principle, with his gas balloon, clumsy indeed in comparison with the birds perfect equipment. And still another insuperable difficulty that besets the human imitator. A tiny bird is gifted with the power of inhaling such great draughts of air as would suffocate a man, and of breathing the rarified air at great heights, and this, too, while flying,

furnishing the motive power with its own muscles. Imagine a man meeting the air at the rate of two hundred and forty miles an hour—the maximum estimate of a swallow's flight—even if passively carried. Or a man ascends in a balloon twenty five thousand feet, beyond which he loses consciousness, or even life. A bird flies by him exulting in the boyant air and flying with greater ease because of it—on and up—who can say how much higher? It scarcely seems an exaggeration to speak of "The lark which sings at heaven's gate." A bird can instantly adapt itself to a different atmosphere. The condor sweeps down from its home in the thin air and Arctic cold of the Andes' lofty peaks to the heavy tropical heat of the ocean levels, "traversing in a moment all climates." Birds of prey are still further endowed with "pinions," that marvellous addition of muscle which enables them with motionless, outstretched wing to float like a cloud in the blue ether, to swoop with lightning flash upon their prey, or curve in slow ascending spirals up the sky, and it is this "repose in motion" which adds the last touch of grace. As the beginning of the wing is found in birds of the sea, so its triumph is reached in the little ocean eagle, the man-of-war or frigate bird. A bird who is above even the demands of millinery to which all else, including the lordly eagle, must pay tribute,—almost above our envy; whose domain is the illimitable sky and the vast wastes of waters. How it fires the imagination even to read of him!

Jules Michelet has well said: "First and chief of the winged race, the daring navigator who never furls his sails, the lord of the tempest. the scorner of all peril. Here we have a bird which is virtually nothing more than wings; scarcely any body—barely as large as a domestic cock—while his prodigious pinions are fifteen feet in span. The problem of flight is solved and overpassed, for the power of

flight is useless. The storm bursts; he mounts to lofty heights where he finds tranquillity.

The poetic metaphor, untrue when applied to any other bird, is no exaggeration when applied to him; literally he sleeps upon the storm. When he chooses to oar his way seriously, all distance vanishes; he breakfasts at the Senegal: he dines in America."

How the earth-chained mortal sighs, as Ruckert says, for

> "Wings! to hover free
> O'er the dawn-empurpled sea.
> Wings! 'bove life to soar,
> And beyond death forevermore."

Language Among the "Lower Orders."

BY O. H. LEAVITT.

Any person who has watched a flock of crows feeding on the ground, with a sentinel posted in some tree in a sightly place, has learned that the birds understand the different calls of the watchman; one being a word of encouragement, as much as to say, "All is well," another when he thinks it is time for another to take his place on watch, and a third when danger approaches and it is time to retreat. All these are noted and observed by the sound of his voice, and without his leaving his perch.

Some people, however, who are accustomed to the sight, are surprised to see the readiness with which the chickens and young turkeys will obey the cry of alarm of the parent bird of either sex, and seek cover without seeing the enemy or knowing what the danger is. But after we recognize the intelligence of animals and birds, this is not surprising, for it is one of the first and most important uses of their intelligence. But poultry keepers observe facts

which carry us a step farther. Turkeys hatched under common hens soon learn the cry of alarm and obey it as readily as if it was in their "native language." I have not seen a hen able to keep young ducks out of the water by her cries of alarm, but they will understand her when other danger threatens. But I noticed an incident recently which goes still a step beyond this. The English sparrows are numerous about my poultry yard, eating and drinking with the chickens and chipping all the time, so that the fowls take no notice of them under common circumstances; but one time, while the two flocks were eating together promiscuously, a cock-sparrow in a tree overhead discovered a cat or some dangerous object on the other side of a board fence six feet high, and gave a cry of alarm, and it was obeyed by the chickens as readily as by the birds, showing that in their association with them they had learned some of their language.

Another incident which may be worth adding to this is my experience with the large black ants. They were traveling on a fence built of large poles and extending about forty rods, one end being at a pond and the other meeting a stone wall on high land. They were continuously on the journey, going and coming, and, while watching them and wondering what they were going so far for and how much they knew, each about the business or duties of the other, I killed one of them, and let the body remain there. The next one that came along went very near his dead companion, then stopped and ran about excitedly for a few seconds, then went back till he met another, and they put their heads together, and in an instant the second was as excited as the first, and this continued on both sides of the source of trouble till quite a number had gathered; then an apparent consultation was held, and the crowd on both sides went down to the under side of the large pole and continued their journeys, and every one that was met

going toward the scene of the "accident" was warned, so that he went on the under side of the pole without seeing the dead ant.

A Useful Family. I.

BY FREDERICK W. BATCHELDER.

Family traits betray themselves in the plant world as surely as they do in the world of mankind. The orchid family, which has formed the subject of the five preceding articles, is a family of aristocrats. This fact is proved equally by its seclusiveness, its thievishness and its uselessness. The members of the family are too dainty to stand on common ground with all sorts of plebians, and so they seek the seclusion of hidden or unapproachable places; they have become too indolent of habit to appropriate at first hand the supplies offered them by mother earth, and so they beg, borrow or steal nourishment from other plants; and they are absolutely of no use, so far as the practical eye of man can penetrate, in the economy of nature. Moreover, like other ultra-aristocratic families, they are slaveholders, compelling their chattels, the insects, to do even their love-making for them, a task which costs many an insect his liberty and eventually his life.

Yet this uncanny family has held its own so well that in number of species it is one of the largest in the vegetable kingdom, not less than 5000 species being known. It has counterbalanced, by means of special contrivances for cross-fertilization, the tendency to die out for lack of stamina. The seeds are destitute of endosperm, and consequently the young plants have scant material to draw from in the most critical stage of growth and need a nurse in the shape of some protecting moss or other humble plant. But what

matter, when every maturing capsule sheds seeds innumerable? Some of them, at any rate enough to ensure the perpetuation of the species, will be sure to find favorable conditions and so fulfil their office.

It may be of interest to note the places in the families of flowering plants occupied by the aristocratic family of orchids and the useful family presently to be considered.

The five largest families and the approximate number of species they contain are as follows:

1. Compositæ, thistle family, 10,000 to 12,000 species.
2. Leguminosæ, bean family, 6500 species.
3. Rubiaceæ, madder family, 5500 species.
4. Orchidaceæ, orchid family, 5000 species.
5. Gramineæ, grass family, 3500 species.

In the matter of distribution over the globe the five families differ greatly. The thistle, bean and grass families are of very wide and general distribution; the orchid family is most abundant in tropical, though fairly well represented in temperate regions; the madder family is almost entirely tropical, being very poorly represented in temperate zones. The only genera of this family with which we are familiar in New Hampshire are Houstonia, including the well-known "bluets," Cephalanthus, the button bush, Mitchella, the partridge berry, and Galium, including bedstraw, cleavers, goose-grass and wild liquorice.

From the standpoint of usefulness, which, of course, means usefulness to man, the differences are fully as great as in distribution. Leaving out the madder family, which is of little consequence in this part of the world, we have remaining four great families, two of which are useful, two useless, or nearly so. The orchid family has a certain esthetic value, derived from the beauty of some of its flowers; it may also be called useful in so far as it incites wealthy and otherwise indolent Englishmen to discover new species and so add to the general stock of knowledge. The this-

tle family, immense as it is, consists almost wholly of plants which the world would gladly miss. It contains the most annoying and pernicious weeds. As a family it represents the socialistic, as the orchids do the aristocratic, side of plant life, and because of this socialistic character systematists place it at the head of all the families of plants. There are two things which the members of the family have carried to perfection, if not excess. One is cooperation, the other dissemination. A dandelion blossom, in which the many flowers are crowded into a compact cluster with a common involucre, illustrates the cooperation; a dandelion seed floating in the air on its winged parachute shows the dissemination.

The other two families are the most useful of all. The bean family, with its fruit which is called a legume, supplies man with many of the most important food stuffs. What would Boston have been, and transcendentalism and Brook Farm and the thousand other notions of Yankeedom, without the brainy staple of Saturday night and Sunday morning, baked beans? The sacred codfish is not to be spoken of in the same day!

But it is the fifth family, Gramineæ, the grasses, that excels all others in usefulness to man. The 3500 species are distributed with prodigal liberality over all the world, except the ultra polar regions. They are at their best, too, in temperate regions, the very regions where men most congregate. With few exceptions they are useful, supplying by their seeds the principal food of man, and by their succulent stems and leaves sustaining the animals on which man depends for flesh food. Though the number of species is less than in the other families the number of individual plants is vastly greater, probably greater than that of the four families together. All our cereals, wheat, rye, barley, oats and maize, are of this family. Millions of human beings live almost entirely on the seeds of a single species, Oryza sativa,

rice. Other millions subsist on species of sorghum. The grasses, then, constitute beyond question that family of plants which is absolutely indispensable to the welfare of mankind and which is accordingly the most important of all.

Come to think of it, setting aside the economic value of the grass family, what sort of a world would this be without grasses? To begin at home, we should have no lawns, except such as might be made up of chickweeds and speedwells and creeping buttercups and daisies and dandelions and plantains and such like assertive but unsatisfactory substitutes. Out in the country there would be no pastures nor fields of grain to delight the eye throughout the season with varying greens and golden browns. There would be no grazing ground, except such as might be supplied in meadow land by sour or harsh members of the sedge and rush families; consequently the flocks and herds, if there were any, would be ill fed, ill bred and unsightly. If we desired to turn out of the beaten path our feet would sink in the turfless soil as they now do when we plod our weary way over a ploughed field. It would not be *our* world at all, but a world much less comfortable and much less beautiful.

To turn for a moment from present aspects to considerations of the past; what would our world have been without grasses? Civilization could not have reached its present stage but for that pastoral era which ushered in the patriarchal system and perfected the institution of the family.

Finally, the loss to literature would have been incalculable. The piping of shepherds, the loves of Phyllis and Corydon, the song of Hebrew bard celebrating the "cattle upon a thousand hills," all these rich and sweet materials of literary art would have been missed. Even the Twenty Third Psalm, that most perfect idyl of sacred writ, could not have been conceived. "He maketh me to lie down in

green pastures'' would have been a phrase without meaning, a cruel mockery.

Stingeth Like an Adder.

BY WILLIAM H. HUSE.

Adder is a word of Anglo-Saxon origin that has passed through a course of evolution from *nædre*, and has relatives more or less remote in all the Germanic languages. The name is given to the only poisonous serpent that inhabits Great Britain, and for centuries all English speaking people have been familiar with the word and its meaning. When the translators of the Bible came upon the passage in Proverbs that warns the wine-bibber against the cup, they found the statement that it stingeth like a basilisk or cockatrice, a fabled reptile whose very breath was noxious. The English readers of the Scriptures, however, were not familiar with those names and the force of ''stingeth like a basilisk'' would be lost upon a Saxon drinker. Consequently *adder* was used as the only English word that would convey an adequate idea of the meaning and has been used until the present time regardless of the fact that neither the adder nor any other serpent can sting.

When the English settled in New England they found three species of snakes near the coast that were mottled or spotted. One had such a noticeable appendage on its tail that it was given the name of rattlesnake; the other two were called adders because of their resemblance to the English reptile, just as several other animals received similarly inappropriate names.

The Puritans could reason from premises and their descendants have learned of them. The English adder is mottled. So are these two snakes. Therefore the latter

must be adders. The old country adder is poisonous. Therefore these must be; and the majority of the children of this enlightened country are brought up to believe that if not all snakes, at least these two are deadly. The fabled power to sting has also been kept alive and active in yarn and gossip, until but one thing, a rabid dog, is considered more dreadful than a snake. Within a few weeks, in this year of our Lord, ninteen hundred and two, I have been told in all soberness of a man who chanced to step on an adder, which immediately threw up its tail and stung him on the foot. I have forgotten whether the man died or not. I presume he did. He probably followed Ananias.

Recently a daily newspaper printed the following item, with headlines more frightful than the text itself:

A ten year old daughter of Fred Andrews, a farmer residing in the Gore district, in the town of Warner, was bitten by an adder, while picking strawberries in a field near her home, a few days ago and is in a serious condition as the result. Beginning with a violent swelling of the injured limb, her whole body is now swollen, and she has been attacked with frequent spasms. Book scientists claim that the adder, a checkered snake common in the fields of our state, is not poisonous, but this is the second case, in that vicinity, where the bite of this variety of snake has been followed by serious results.

A farmer in the town of Newbury was bitten in the foot by an adder a few years ago and showed signs of poison similar to those exhibited by the Andrews girl. Physicians saved him at the time, but he remained in poor health for a year or two and died.

The story would not have been worth following up if it were not that such accounts perpetuate the unnecessary horror that people have of snakes. The case was investigated and it was found that the girl was stung by something. She did not know what but supposed it was a snake. There was some swelling on the ankle near the sting and portions of the body were spotted. The latter symptom, which may be caused by anything which disturbs the cir-

culation of the blood, was probably the reason for ascribing the trouble to a checkered adder. It is evident from the testimony that the spasms were due to hysteria after hearing stories told by those old enough to know better, of the terrible effects of snake bites. The girl has recovered from the effects of the adventure except the fright that still seems to affect her somewhat.

Investigation of the second case mentioned, which occurred several years ago, makes it appear very doubtful if the man's death had anything to do with the snake bite.

Thus ends the latest snake scare. In the meantime the force of the temperance exhortation is valid.

The Little Weaver and What She Wove.

BY SUSY C. FOGG.

There is a small uncultivated area in which has gathered an interesting company of cosmopolites, a veritable weed garden, with barriers that no well balanced human being would ever penetrate, but watching from the outside there seem always to be signs of great activity and much a-doing within.

In winter, when the north wind blew, the small birds feasted bountifully on the seeds as they were shaken from out the dry capsules of last year's stalks onto their snowy napkin, and here, in spring, was the first tinge of delicious green and the croak of the early frog.

As the season advanced, insect and other life in air and water multiplied, and among the flowers was a gay intermingling of colors, in preparation for the one end, the fruition which was yet to come.

Along the wall were pretty clumps of elder and alder and trailing clematis, and farther in was the burdock, a bit of golden-rod, the water hemlock, the Bidens, which would

stick your clothing full of "pitchforks" when you knew you did not touch it; they would be horrid if they were not so interesting; the agrimony held up its stalk of urn-shaped burrs, and in among them all the grasses and sedges held sway.

Well, this was the place, and it was a safe retreat for the weary and pursued or the most careless and joyous of lives. At any time in the summer, while passing along the highway, I could observe a gayly-colored spider that had set up housekeeping a few feet from the road. She had looked over the place with her eight bright eyes, and had decided to make her web in an elder bush, which we could see with our two eyes was the nicest choice in the world.

The web was of the finest silk, of roundest pattern, and always kept in perfect order by the small owner, who appeared to do nothing but stay at home, hanging head downward near the center. I admired the jetty black in which she was clothed, relieved by the short jacket of silver-white hairs and the bright yellow spots and spangles on the body, and came to have an affection for my little orb-weaver, my Epeira riparia.

But one day, when nobody was looking, this mother spider did something more that was interesting. She half concealed, in a golden-rod stalk which grew next door, a large pear-shaped egg-cocoon, perhaps one and one-half inches in length, with a partial opening at the small end. The sac was firmly attached by strong threads, and was colored like a dry oak apple, or as the stalk would be through the bare cold winter.

The protection might have been mere accident; it would seem like reason. Mr. Moggridge gives an incident relating to a trap-door spider which proves that the spider possessed instinct, acquired by custom, but not reason, in protection of its nest. The spider had been accustomed

to conceal its door by fastening upon it some of the moss which surrounded it, but when the moss was cleaned away and the cover of the nest destroyed, the spider made a new door and brought moss from a distance to put on it, thus making the cover the most conspicuous thing in its vicinity.

But to return to the golden-rod. Here was a temptation and a prize that must be captured for the Two Little Naturalists; so the stalk was cut away, bearing its queer fruit. This was in early autumn; the eggs might not be hatched, and we agreed to lay it aside, that the young spiders might live their lives in their own way. We shuddered at the thought that the strong would be nourished by the weak, but that is one of spider principles.

When it was about time for the young cannibals to emerge in the spring we decided to have an opening and The Two Little Naturalists made an attempt to tear apart the sac with their fingers. It could not be easily torn for the cocoon was dry as parchment, and stronger and tougher than that used in the nest of the common wasp. A pair of scissors lay open the walls of the sac neatly and disclosed a ball of the most beautiful, snuff brown, silken floss soon made animate by the sudden stirring of the baby spiders.

A suppressed "oh!" from the children manifested their eager interest. In trying to remove a single spider, four strands of the silk caught on the point of the forceps only to break one after another until but one was left. The Two Little Naturalists had a happy thought! One took the forceps with the thread attached and the other the box in which lay the reel of floss, and by a gradual drawing apart, succeeded in reaching opposite corners of the room, still holding the glistening line which according to my ribbon measure was fully six yards long.

It seems probable that in proper space, and with like patience and gentleness, the entire ball might have been unwound, and I longed to continue the pleasant pastime of

watching the unconsciousness of childhood and the filmy thread.

Its strength and tenacity made evident the fact that silk of spider manufacture might be of high commercial value. It is said to have a more beautiful luster than that of silk-worm production, and the capacity of some species is of sufficient amount to make the experiment profitable, did it not require so much time to separate the strands from cocoon or directly from the spider itself.

Other difficulties in the way are the nature of food required and the antagonistic spirit which prevails between the sexes, or the utter disregard of kin, which makes necessary the keeping of each spider separate, making large demands upon room space.

The experiment of silk manufacture was tried in England not long since with a species of spider imported from Africa which furnished large quantities of silk. It was believed at first, that it would prove successful, but for some of the causes just mentioned it was found impossible to breed them in large numbers; and that the silk would become too expensive for use.

We know that some ants keep "cows," that others grow grain and harvest it, and that others still grow mushrooms under ground. Now comes another story of ant sagacity. Not long ago a French explorer, M. Charles Meissen, in traveling through Siam, observed a species of small gray ants which were new to him. To his surprise he noticed among them from time to time an occasional ant which was much larger than the others and moved at a much swifter pace, and each of these larger ants, M. Meissen saw, always carried one of the gray ants on its back. This discovery led him to watch their movements closely. He soon saw that while the main body of their own sort mounted on one of these larger ants, he mounted and detached himself now and then from the line rode rapidly to the head came swiftly back to the rear, and seemed to be in command of the expedition.

Nature Study Lessons. VI.

BY EDWARD J. BURNHAM.

Nature study, rightly employed, not only develops the faculty of observation but tends in a special degree to stimulate and strengthen the reasoning powers. No thoughtful person who has taken a walk with children has failed to notice the frequent repetition of the question why. It recurs continually. So many things are seen that had not been observed before, so many other things present a new and entirely different aspect and the children are eager to know the reason for all that they take note of. So closely are the observing and reasoning faculties associated if we would but perceive the natural result of observation.

It is so easy to attempt a reply off-hand; to answer the eager inquiring mind and have done with the question at once and for all. To be sure, we do not know ourselves. If we were truly honest the very wisest of us, we should many times say frankly, "I do not know," but we forget to add, "Let us try to find out." Even if we do know or think we do, it is better for the children that they be encouraged to find out for themselves. The effort will be good for them, and at the same time they will enjoy it, there is no greater pleasure in the world than that which comes from original observation and original deduction from the facts observed.

By answering the questions propounded, we may gratify our vanity as seeming to show the wide extent of our knowledge, but if we have the best good of the children in mind and are wise in our attempts to promote it, we shall frequently remain silent or, at most, merely venture such suggestions as shall tend to quicken thought. The child is almost always a keen observer, but needs to be encouraged to make comparisons and to reach correct inferences. It is

well worth while to observe a single creature or plant carefully and take note of its structure and habits; but it is worth much more to compare one plant or animal with another plant or animal and become familiar with the differences between them; but if we can draw a correct inference from the comparison, that is much the best of all. If the inference is new as well as correct, we may add to the sum of human knowledge; if it has been reached before, we still have all the advantages to ourselves of original investigation and discovery.

The field for the exercise of these faculties of observation, comparison and inference is so broad that good examples are sure to occur to any thoughtful parent or teacher, but a convenient illustration is afforded by a study of the location of

THE EYE.

Where are eyes placed in the dog and cat? Where in the rabbit and sheep? Think of all the animals you have seen, as the squirrel, the cow and the horse, with special reference to the position of the eyes in the head. Then look at the pictures of animals which perhaps you have not seen, as the lion, the tiger, the bear, the deer, the antelope and the giraffe.

It appears that some animals have their eyes in the front of their heads. Why? Others have their eyes on the sides of their heads. Why?

Here are two facts gained by observation and comparison. There is a reason for every fact in nature. Let us find the reasons for the facts we have learned about eyes by observing and comparing different kinds of animals.

How do cats and dogs live when wild? How do lions and tigers live? Are the eyes of these and other creatures that hunt, and live upon what they catch and kill, in front or on the sides of the head? How do rabbits, squirrels,

sheep, deer and antelopes live? Do they hunt, or are they hunted? Where are their eyes? We begin to see the reasons for the facts we have observed, and are surprised that we had not thought of them before.

Those animals which hunt other animals must catch something to eat or starve to death. Hunger is their greatest foe, and their eyes are placed in the front of the head that they may pursue their prey successfully. Those hunting animals whose eyes were on the sides of the head, if there ever were any, all died of starvation long ago.

Those animals which graze or browse, or live on nuts and seeds, commonly find food abundant, but are constantly liable to attacks from beasts of prey. With eyes on the sides of the head, they have a wide range of vision, and by turning the head a little either way, can take in the entire horizon at a glance. A cow, in grazing, moves her head from side to side. It is not as much in expectation of larger or sweeter mouthfuls, as that she may see what is going on around her. Most cows in America have never been in danger from beasts of prey in all their life time, but their ancestors were often in such danger, and they have not lost the habit of watchfulness.

Notice the owl's eyes, as shown in a picture or stuffed specimen. Where are they placed? How does an owl get its living? Notice a hen, a dove, a robin or any of the song birds. Where are their eyes placed? They are almost always in danger of being seized by an owl, a hawk, a fox or some other bird or beast of prey. What is the effect, in their case, of moving the head from side to side? Watch them, and see what a constant and universal habit this movement of the head has come to be.

Some day visit a brook or pond and watch the minnows. They live upon insects and other tiny living things in the water, but they are almost constantly pursued by larger fishes that prey upon them. How are their eyes placed?

The sun-fish or "pumpkin-seed," that every boy knows so well, makes a round, hollow nest in the sand, and hovers over it, watching and ready to fight to keep other fishes away. Its eyes are on the sides of its head, and it turns frequently while on the watch. No enemy can come near unobserved.

The pickerel catches other fish, frogs, and sometimes even a bird. Watch it as it lies among the lily-pads, or study one that has been caught, and notice that its eyes are on the top and in front of its head.

Almost every boy and girl, nowadays, knows the tiger-beetles and the ground-beetles. These live by eating other insects. Where are their eyes? Notice a grasshopper. Where are its eyes? Is it easy to catch a grasshopper? Notice that the eyes of butterflies and moths are on the sides of the head and that most of them fly with a zigzag motion,

Now, then, we have observed beasts, birds, fishes and insects, and have compared them among themselves. We have found that in each class some have the eyes in front, while others have them at the sides, of the head. By observation and comparison we have reached an inference which we are sure is correct, and we may safely formulate a general law, as the scientists say, which is that among beasts, birds, fishes and insects those creatures that hunt have the eyes placed in front of the head, while those that are hunted have the eyes placed at the sides of the head.

This lesson, then, is an illustration of the possibilities of nature study in the development of the faculties of observation, comparison and inference—a development of so great importance to the child that sooner or later nature study will be universally recognized as an essential factor in any system of education.

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Nature Study...

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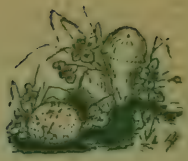

NATURE STUDY.

A monthly magazine, published under the auspices of the Manchester Institute of Arts and Sciences. EDITOR: Edward J. Burnham. ASSOCIATE EDITORS: Frederick W. Batchelder, William H. Huse, Susy C. Fogg, Theodora Richardson.

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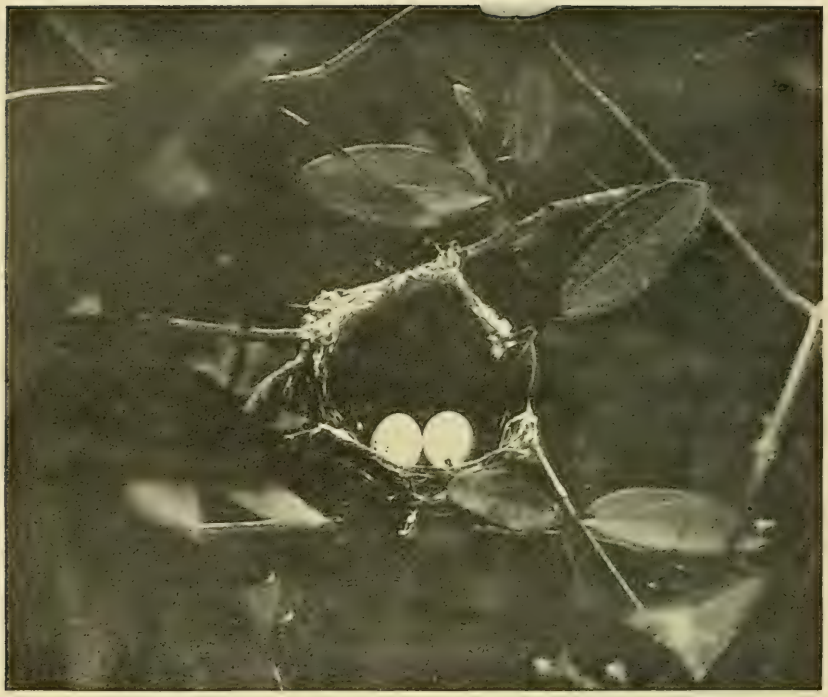

NEST OF RED-EYED VIREO.

Photographed for Nature Study by PERLEY H. RIDDLE.

NATURE STUDY.

PUBLISHED UNDER THE AUSPICES OF THE

Manchester Institute of Arts and Sciences.

VOL. III. December, 1902. No. 7.

Only a Red Eye.

BY EDWARD H. FOGG.

How many times when out with a party for a bird walk, some one will say "Hush, I hear a bird note!" We all come to a halt and listen. Then another member of the party adds "only a red eye." To be sure it *is* a Red Eyed Vireo, but why the *only*. Let us stop a few minutes and listen to his song, that has been so variously commented upon by poet and naturalist. With a clear sweet, intonation he says, "You know it. We see it. Verily, cheerily, cheery are we," meantime hopping about from twig to branch in quest of food, stopping in his song scarcely long enough to swallow the morsels which he finds, usually in a very contented manner, and as one naturalist has said "he seems to give thanks for every bite." As opposed to this, another writer calls his song the "tiresome platitude" of the red eye, another complains of the monotony of his song, another in comparing his with another Vireo's, says what a contrast between this and the red eye's comparatively meaningless and feelingless music.

It seems as if much depended on the listener, the song must respond to something in us, our mood as it were—

lovers have no use. The rational impressionist is nearer to nature than the academic hack or the sensational color splasher. The latter should go to Yellowstone Park. There he will find himself beaten by nature!

From pure green, which may be taken as the type color of the grass family, the shades and tints of the different species approach on the one side the blues and on the other side the yellows. Everyone has heard of Kentucky blue grass and doubtless many have wondered, as I once did, what shade of blue it was and what sort of a tone it gave to the landscape in the "dark and bloody ground" of American history. Unfortunately, the term blue in this case is a sad misnomer. I recollect how surprised and disappointed I was when first I learned that this grass was nothing more nor less than our common June grass, *Poa pratensis*, and accordingly no bluer than that. But there are grasses in which the tendency towards blue is evident. The best example of this is the English or Canadian blue grass, *Poa compressa*, a native of the old world, but now thoroughly established here, and one of our commonest species. A tuft of it growing amongst the ordinary green grasses forms a bluish patch which is distinguishable almost as far as the eye can see. Two other grasses with a decidedly bluish aspect are blue-joint, *Calamagrostis Canadensis*, a tall, reed-like species growing in moist places, and sheep's fescue, *Festuca ovina*, a low, densely tufted species of dry ground, with narrow and innumerable basal leaves.

On the other side of pure green come the numerous species which exhibit more or less yellow in their coloring. These are less striking than the blue grasses, for the admixture of yellow impresses us as being perfectly normal, and the numberless yellowish greens appear to be only so many tints of the green itself.

All these variations from the type color are to be seen in grasses when they are at their best as plants, that is, at the

time of inflorescence. After flowering there occur those changes in color which result in the yellows and purples and golden browns that give the landscape in late summer and in early fall its peculiar beauty.

There is one trait of the grass family which causes it to be a peculiarly favorable subject for study both by the botanist and the artist throughout the season. This is the prolongation of the period of inflorescence. Though the individual plant is in flower but a short time, usually from one to three days, differences of environment may make a difference of several weeks in the time of flowering of plants belonging to the same species. Moreover, the normal flowering time of the various species extends over a period of not less than six months. With us the earliest species are in flower by the last of April and some of the latest species have not finished blossoming until the last of October. I am speaking only of indigenous or thoroughly wild grasses whose times and seasons are not regulated by the will of man. In the landscape, of course, the cultivated grasses must be reckoned as factors.

Late in April, provided the kindly sun has by that time vanquished the snow, the first grass in flower may be found springing up about the edges of lawns and strips of turf in cities and villages. This is the annual spear-grass, *Poa annua*, an introduced species. The basal leaves form a large part of the greenery in our lawns and cannot of themselves be distinguished from those of some other species. A few plants escape the lawn mower and succeed in sending up, besides leaves, a stem, called in the grass family a culm. On this is borne the inflorescence, an open panicle on the branches of which are the flowers, collected together in little flattened bunches called spikelets. The flowers will scarcely be recognizable as such unless the observer is fortunate enough to be in the nick of time, when the three anthers and the two feathery stigmas have pushed apart

the tiny scales and thus revealed the love secret of the family.

Almost, if not quite, as early as this cultivated species, there come into flower the two earliest wild species in the vicinity of Manchester. These are to be found in dry places where few other grasses will thrive. They are the so-called mountain rice grasses, *Oryzopsis Canadensis* and *asperifolia*, both growing in large tufts, with densely matted rootstocks and erect or slanting culms, the former species with very numerous, narrow basal leaves, the latter with fewer, broad and very long leaves. With the flowering of these two species the annual procession of the grasses is begun.

Even more beautiful than the shades and tints of green are some of the purples of the grasses. Before the ripening of the pollen the anthers are in many species bright red or purple. The leaves and stems often turn crimson or scarlet after decay has set in. There is one grass of late summer or early fall which is surpassingly beautiful in color and line and mass and *motion*. I use the word motion with deliberate intent. On dry, gravelly plains where scarcely anything else will flourish may see in August a tall grass growing in rather large tufts. The basal leaves are broad, for a grass, and the culms are slender, with closely appressed, upright branches. As yet there are no marked indications of beauty. Visit the same plain a month later and it seems as if a magic spell had been cast over it, transforming those homely tufts of coarse grass into thing of transcendent loveliness. The highly polished stems have taken on the most exquisite tints of purple and brown and yellow. The flowers have opened and disclosed tiny feather-like collections of glistening, white hairs. Then when the sun shines, bringing out and heightening every tint, and when the wind sweeps along, swaying every tuft and

presenting new lines and new tints and new reflections every instant, the spectacle is one of the most enchanting which can greet the eye of the nature lover or artist. Only an impressionist. and a wise one at that. could represent such a scene, for only such an arist would be able adequately to suggest motion.

Pictorial art, then, as well as literary art, would have missed much through the non-existence of the grass family. The world would have been poorer, not only in those food stuffs which renew the exhausted muscle and enable the brain to work to advantage but also in those subtler combinations of matter and force which tend to bring us, through closer harmony with earthly things, into eloser harmony with things divine.

Ants and Aphids.

BY EDWARD J. BURNHAM.

About the first of November, as we were removing a large wooden box from the garden, we found small cavities beneath it which were almost literally packed with the white aphids, or plant lice, that we had long known as being especially cared for by the Yellow Meadow ants. Many of these ants were also beneath the box, and it was evident that they had taken their "cows" into winter quarters.

One warm day in early April I came upon a small boulder, partly buried in the earth, whose upper surface, sloping toward the sun, was roughened by several pits or depressions. In these pits, sheltered from the wind and warmed by the sun, were many white aphids, of the same kind as those found beneath the box in the garden. These aphids still have legs and feet, but have nearly lost the use of them through long dependence on the ants, which fur-

nish transportation for them. There were also many of the Yellow Meadow ants moving about over the stone, and going and coming between the earth beneath and the surface above.

Plainly, the ants were giving their "cows" an airing, much as nurses take out small children on a warm spring day. I lifted a smaller stone and struck the boulder sharply, giving it a considerable jarring. Immediately the ants hastened to the aphids, each seizing one in its mandibles and carrying it quickly below. In a few minutes there was not an aphid in sight, and only an ant here and there, moving about as if to make sure that none of the aphids had been overlooked. Returning an hour later, I found that the aphids had been brought back to finish their sun bath, while the ants were moving leisurely about, as when I first observed them.

One day in the first week in May, as I was turning stones in search of insects, I came upon a colony or "herd" of these white aphids, clinging in rows by their sharp beaks to a juicy root, evidently of some herbaceous plant which had not yet sent its scape or stalk above ground.

At that stage I could not determine the order of plant to which the root belonged, but I removed a portion to a box, together with as many of the ants as I could secure, and carried the collection home. There I carefully detached some of the aphids and placed them at the opposite end of the box, several inches away. In a short time the ants had found them and replaced them upon the root, where they went on sucking the juices as if nothing unusual had happened. The box was purposely left open, and the next day only the dried root remained. The ants and their "cows" had disappeared.

In June white aphids were found in abundance on the roots of the cultivated lettuce in the garden, and the Yellow Meadow ants were numerous about them.

Late in July, when the ants and their cows were thought of again, the lettuce had all been removed from the garden, and there were neither white aphids nor that particular kind of ants to be seen. Then came an idea. Nearly all insects that feed upon plants are wonderful botanists. Perhaps these ants that take such care of their aphids may have learned something of botany too.

The garden lettuce, *Lactuca sativa*, belongs to the order Compositæ. In the same order an allied genus is Taraxacum. *T. dens-leonis* is the dandelion. There were several dandelion plants at the edge of the garden, two or three rods away from the lettuce bed. We hastened for a trowel, and, sure enough, the first dandelion root examined was covered with the white aphids, and many of the individuals of *Lasius flavus*, the Yellow Meadow ant, were moving contentedly about near by.

This was the last we saw of the ants and their "cows" until we found them beneath the heavy flower-box in November.

He roved among the vales and streams,
In the green wood and hollow dell;
They were his dwellings night and day,—
But Nature ne'er could find the way
Into the heart of Peter Bell.

In vain, through every changeful year,
Did Nature lead him as before;
A primrose by a river's brim
A yellow primrose was to him,
And it was nothing more,

—[Wordsworth.

Local Bird Notes.

BY ANNIE V. BATCHELDER.

1. DENDROICA CÆRULESCENS IN NOVEMBER.

On the morning of Saturday, October 25th, three small birds were seen flitting about our purple beech. Field glasses were speedily brought into requisition, and to our great surprise the birds were identified as immature male black-throated blue warblers. As the latest date given in Chapman's Handbook for this species is October 10, we watched these visitors with intense interest. They remained about the grounds the greater part of the day, feeding mostly in the apple trees. We made the usual observations and records, and when night came marked that Saturday as a red letter day in the calendar.

Yet this was only the beginning of wonders. Sunday, the 26th, the birds appeared again, and with them was an adult male, an elegant fellow in blue and jet black and white. They were all so tame that they could be approached closely, sometimes so closely that they could almost have been caught in the hand. For the next few days we had only an occasional glimpse of the visitants. Meantime an observer in another part of the city brought us a minute description of a bird seen there. This proved to be as accurate a description as could be desired of the black-throated blue warbler.

On Saturday, November 1st, appeared a second adult male, apparently a little maturer than the first one. The two fed side by side in an apple tree so that we were able to note minute differences. In the new comer the black of the throat extended down to the upper part of the breast, and the markings on the sides were more pronounced. Both these birds were also seen on the next day, Novem-

ber 2nd, but the immature birds disappeared after the 1st. On the 7th the adult males were again on the grounds, looking as happy and unconcerned as if there were no such thing as winter. Then for nearly a week we missed them and concluded they had at last undertaken the long journey to the tropics. (It is worthy of note that no females were seen at any time.)

What was our astonishment on the 14th to see an adult male, apparently the more mature of the two previously seen, serenely feeding in the apple trees! Again on the morning of the 15th there he was in the purple beech! This was too much. We felt certain we should be set down as impostors if we dared publish our observations without corroborative evidence. On the instant we telephoned the Pinfeather Ornithologist—who, by the way, has long since outgrown her modest "nom de plume"—to come to the rescue. In less than two minutes she had her glass on the bird, and we knew that, ornithologically, our salvation was assured. The climax was capped on the morning of Sunday, the 16th, when the Full-fledged Ornithologist, who has written so charmingly of gulls and terns, was favored with a perfect observation and so enabled to add the weight of his testimony.

This was the last time we saw these belated warblers who for twenty-three days, October 25th to November 16th, had so delighted and puzzled us. Why were they here? Let someone answer that question who knows!

2. A WINTER WREN.

The winter wren is so rarely seen in this vicinity, or, at any rate, so rarely recognized and reported, that the record of an observation may be of interest. On the afternoon of the 29th of October, while walking up the easterly extension of Webster street, I saw what might have been

a brown leaf whisk across the road close to the ground. Still, the motion was a little too brisk for a wind-swept leaf and I turned my glass toward the vanishing point of the object. Sure enough, it was a tiny bird and one I had never seen here before, though I had both seen and heard it at Jefferson and at Mt. Chocorua. The cinnamon-brown body the little perked up tail and the quaint, bobbing movements at once showed the bird to be a wren, and subsequent close inpection revealed the characteristic markings of Troglodytes hiemalis.

Last season the species was observed here by Dr. W. R. Varick, who was so fortunate also as to hear the song.

3. OUR SAPSUCKER.

A good sized European white birch near the house is a favorite resort of sapsuckers during both spring and fall migrations. One of these birds we call *our* sapsucker, for we are reasonably certain that this one, an elegant male, is a regular semi-annual visitant. He first came to the tree Sept. 26, 1898, remaining about three weeks. For a few days he worked hard, boring not less than a hundred holes in the bark, most of them in a ring about fifteen feet from the ground. Having thus nearly girdled the tree—for the safety of which we were not a little alarmed—he subsided into a condition of indolence and thereafter spent most his time dipping his bill into the holes and sucking the sap with evident satisfaction. We observed that in boring he slanted his bill considerably until he had penetrated the outer bark, after which he struck directly forward; also that in drinking he probed deeply and with great deliberation.

It was evident from the length of the bird's stay that he had discovered a rich feeding ground. Subsequent occurrences showed that he intended to keep this for his exclu-

sive use. As discoverer he had an undoubted right to do so. But in some way, mysterious to us, however simple it may be to our feathered friends, other sapsuckers very soon discovered his discovery. When they tried to make themselves free with it the pioneer seriously objected. The trespassers came in numbers varying from one to six, one mature and four immature males, and one female composing the total. To the female, who may possibly have been his mate, he manifested no special hostility so long as she did not actually encroach on his particular feeding ground for the time being. When any of the others came to the tree, he drove them off with fury, at the same time uttering tremulous, snarling cries, not unlike the scolding notes of the yellow-throated vireos, but more nasal and disagreeable.

Our bird returned the next spring and has visited us regularly at each migration since. His spring visits have occurred early in May, lasting usually but a few days. In fall he has arrived late in September or early in October, remaining from ten days to three weeks.

It has been a source of great amusement to us to watch the conduct of the English sparrows during the sapsucker's visits. With their usual inquisitiveness they follow the sapsucker about, peeping into the holes he has made, and inserting their bills when they can reach to do so. Occasionally they essay the tactics of the humming bird and try to remain motionless on the wing long enough to test the quality of the sapsucker's larder.

This fall our bird appeared October 10, and at once proceeded to bore a new ring, or rather zone, of holes, some eight feet higher up the trunk than he had worked before. His stay was short, and for a wonder he was not interfered with by other individuals of his kind. But soon after his arrival a succession of snarling cries notified us that there was trouble in camp. On looking out we saw

not another sapsucker, nor yet the intrusive sparrows, but of all birds about the last we should have expected, a *downy woodpecker*, infringing on our old friend's preserves! To our delight the intruder stood his ground like the little hero that he is and remained on the tree seemingly as long as he cared to. But we were amazed to see that he repeatedly dipped his bill into the holes the sapsucker had made, and appeared to be imbibing the sweet, enervating liquid! Will downy, in the course of time, degenerate into a sapsucking bird, lose his "snap and go," and wax fat and lazy?

One would naturally suppose that the sugar maple, from which man draws such delicious saccharine material, would be of all trees the favorite of sapsuckers. This does not appear to be the case. Frank Bolles, in his observations on the habits of the sapsuckers at Mt. Chocorua, names the canoe birch and the red maple as being the most frequently chosen by them for their operations. It so happens that our birch stands between a sugar maple and a red maple. The sapsuckers frequently alighted on these trees and occasionally acted as if about to commence drilling, but they always gave up after a few feeble strokes, and returned to the birch, which evidently yielded quicker and larger returns for the same expenditure of effort. Our own observations for these five seasons also compel us to endorse Mr. Bolles's conclusion that the birds consume the sap in large quantities for its own sake and that sap drinking occupies their time to a much greater extent than does the pursuit and capture of insects.

Nature Study Lessons. VII.

BY EDWARD J. BURNHAM.

There is an exhilaration in a winter's walk, such as the finest summer's day cannot afford. For the healthy child, and for the robust of any age, there is a buoyancy in the crisp air and a delight in meeting the obstacles of cold and ice and snow. If, toward the end, there is temporary discomfort, it is over balanced by the thought of warmth and food at home.

The mystery of life seems deeper in the winter time; its forms are in general less familiar, and the wonder at its marvelous abundance increases continually. For even in the shortest and coldest days life is everywhere. There is life in the trunks of the trees, in their roots and in their branches; swelling life in the buds that already give promise of future leaf and blossom and fruit. There is life, too, in the roots of the myriads of plants beneath the snow, and abounding life in the millions of seeds, awaiting only the signal of spring to expand and assume countless forms of beauty and strength, of bloom and fruitfulness. There is higher life, also, animal life, in wonderful profusion and variety—countless links in a chain of unending development.

The winter birds have returned to take the places of summer friends that have gone away; each new snow is crossed and recrossed by the tracks of innumerable furry, hungry, living things, and the brooks and ponds teem with life beneath their winter covering of ice. There is life, full, abounding life, packed away in the dried and hollow stems of plants; in the raspberry canes; in the branches and twigs of elder and sumac; countless creatures sleeping away the winter in cocoons, or, with tireless persistence, forcing a way to the hearts of the stout-

est trees; and life in the myriads on myriads of tiny eggs, tucked away by insect mothers hopeful that some may escape the sharp eyes which are looking for them in the great game of hide-and-seek that is going on everywhere unceasingly.

This game of hide-and-seek, fearsome in its intensity, awesome in its stern necessity, in which the prize is life and the forfeit is death, presents many nature study lessons that may be learned as readily on a winter's day as in the more luxuriant summer time. In our Decembar walks, as at other seasons, we must not neglect to show the children at least passing glimpses of nature's wonderful, far-reaching scheme of

PROTECTIVE COLORATION.

Watch a brown creeper as he goes round and round the trunk of a tree, always rising, until, when near the top, he drops noiselessly to the foot of another tree and begins his plodding, spiral round again. He is hunting for insects and insects' eggs, hidden in the crevices of the bark. The eggs are tiny, and both eggs and insects are almost exactly of the color of the tree. He can by no means find them all, and yet he is the most patient, persistent, keen-eyed searcher in the world. If the insects and their eggs were not thus protected by their color, so that some escape, there would soon be none of their kind anywhere.

But the little brown creeper has enemies, too. There are hawks and owls as hungry as he, and shrikes that are the most cruel of them all. Now notice how well his color corresponds with the gray tree trunks on which he seeks his food. He has no noisy companions, as the jays have, to warn him of danger, and his only safety is in his plain coat of brown and buff, and in his quiet ways. Not all of his kind escape, but some of them do, and so we have brown creepers with us every year.

If we watch a nuthatch, as he runs up and down the trunks of the trees, we shall see that his color also is wonderfully adapted to his surroundings. Even the white stripes on the sides of his head and neck help to hide him, for, as he moves quickly about, they look almost exactly like flashes of sunlight glancing through the branches of the trees and falling on the brown and gray objects around him.

The Chickadees and the Kinglets, too, have coats that agree well with the general effect of the trees in winter. The former show narrow stripes of white, and the latter have bits of orange or ruby on their heads, that their friends may know them, for they are fond of being in company. But none of these "recognition marks," as they are called, is very conspicuous, and probably affords little aid to their enemies.

The Snow Bunting is a fine example of color protection. His dirty white coat helps him in the most contrary situations. On the brown, bare ground in winter time, he cannot be distinguished from sticks and stones at a little distance away, while on the snow he can scarcely be seen at all.

The Bluejays appear at first thought to present a marked exception to the general rule of silence and protective coloration. They are often extremely noisy, and their blue coats would seem to make them conspicuous. But a little observation of their habits will show that nature has not forced them to take unnecessary chances. They go in flocks and each individual is constantly on the watch. The moment an enemy is discovered, an alarm is given, they scatter a little and alight in the tops of the trees, where their blue coats, against the blue of a winter sky, renders them almost invisible. Any one who has tried to find them after they have been disturbed, knows how difficult a thing it is. So they are wonderfully protected after all.

The hawks, owls and shrikes are protected by their color, but their protection is against hunger rather than against other creatures. They are birds of prey and must catch other living things in order to live themselves. If they were so conspicuous as to give warning, they would starve. So we find that a dull gray hawk, flying noiselessly through the woods in fall or winter often appears to be little more than a momentary shadow from some passing cloud.

The owl does not fly about to seek his prey, but perches on a dead limb, or on some tall, branchless stub, and waits and watches. His dull colors fit so well with his surroundings that he is well-nigh invisible.

The shrike has habits somewhat like the owl, but is a bird of the daytime. He will wait on the outer branches of a tree until some small bird alights near by, when he will dart straight for his victim, which, if caught, he impales on some thorn or forked twig, as every child knows nowadays. As he waits in this way, although perched in full view, his gray color so well matches the clouds above and the prevailing dull gray of winter that he is rarely seen, even by those who, with trained eyes, are looking for him.

NATURE STUDY has received from the Massachusetts Audubon Society their Calendar for 1903, published under their auspices by the Taber-Prang Art Co., Springfield, Mass. It is a beautiful work of art, fully equal to its predecessors. The colored pictures of birds were prepared by Mrs. J. W. Elliot, of Boston. They are six in number being accurate and at the same time artistic portrayals of the Snow Bunting, Fox Sparrow, Baltimore Oriole, Wood Thrush, Meadow Lark and Red Crossbill. Moreover, each bird portrait is charmingly placed in an appropriate setting of landscape or foliage, suggestive both of the season and the habits of the species. In the coloring of the plumage, the artist has been remarkably successful, so that the Calendar will be, throughout the year, a delight and a source of inspiration.

Wild Flowers in November.

Hunting wild flowers in November seems odd, when to the every day mortal the leaves, turned scarlet and gold and brown, are chief among the delights of a ramble in the woods.

It so impressed the writer when, a day or two ago, he started out with the Torrey Botanical Club, on the first of its autumn field meetings—the programme phrase for a veritable scouring of hill and dale for rare plants and floral oddities—round about Eastchester.

Now, the Torrey Botanical Society, as those of scientific turn well know, is a body of 400 botanists—some of them celebrities and world famed authorities, and some amateur enthusiasts—who meet fortnigtly in New York in the pursuit of their favorite study.

The field days are specimen hunts, when new and strange flowers, oddities in mosses and fungi are collected for discussion and study at the meetings of the club.

With the idea uppermost in his untaught mind, that a November flower hunt was doubtless the weird fancy of a coterie of enthusiasts, the writer went, saw and was conquered by curious mosses, strange fungi and an anomalous pussy willow putting forth silvery-furred blooms in contradiction of the law of season.

Guided by Mrs. N. L. Britton, wife of the director of the New York Botanical Garden in Bronx Park, and a specialist in mosses, the club began its jaunt from Wakefield. With the party were Dr. George N. Carleton, professor of botany in Columbia College; Edmund B. Southwick, entomologist, or, popularly, the "bug man" for Central Park, and Mr. George Nicholson, the celebrated English scientist, for many years in charge of the Kew Gardens, in London, author of a four-volume dictionary on gardening, and delegate for the Royal Horticultural Society of Great Britain to the international conference on horticultural hybrids held in this city early in October.

The freak willow was discovered by Mr. Nicholson, growing in a lane on the outskirts of Wakefield. The branches were literally covered with the fluffy blooms, and half a dozen youngsters were climbing in the tree, picking the "pussies." Scores of these willows in the vicinity were as sere and yellow as autumn could make them, but this lone tree was entirely springlike.

Inquiry among near-by residents revealed the fact that this same willow never blooms in spring, but regularly each autumn its sil-

very blossoms appear in profusion. The botanists agreed that they had never seen or heard of a similar instance.

After the party had "sampled" the odd willow, the mosses, deeper in the wood, aroused the enthusiasm of the entire party. A lively discussion of the velvety green patches revealed the fact that within a radius of twenty-five miles of New York no less than 250 distinct varieties of moss can be found.

Short-stemmed, brilliant green rock moss, moss with tiny brown fruited stems growing from it, coarse, grey moss, said to be edible for reindeers, and a queer-looking, long-stemmed moss known as "pigeon wheat" or "hair cap," attracted especial attention and specimens of each one were secured. The "hair cap" moss is used extensively, Mr. Nicholson explained, by the gypsies of Europe for making fine brushes for uses similar to that of the tiny feather dusters for bric-a-brac.

The enthusiasm of the English guest reached its height when the fungi, or plant parasites, came in sight. Of these about 3000 varieties exist in the woods about the suburbs of New York. One fungus growth on a fallen tree so excited him that, magnifying glass in hand, he lay prone upon the ground for several minutes carefully examining the moldy specimen. Expressions of "beautiful," "splendid" and "fine" gave evidence of his scientific delight at his "find."

Some 200 specimens of mosses and fungi were gathered during the morning. One of the party found violets, only a few to be sure, but violets, in a shady nook in the woodland.

Sumach, its brilliant red dimmed by frosty winds, pin oaks, with leaves all out of proportion to their slender stems, odd silvery mildews on the leaves of the spice bush, varied growths and fungi all became points of interesting discussion.—New York Mail and Express.

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Nature Study...

Vol. III JANUARY No. 8

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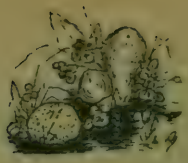

NATURE STUDY.

A monthly magazine, published under the auspices of the Manchester Institute of Arts and Sciences. EDITOR: Edward J. Burnham. ASSOCIATE EDITORS: Frederick W. Batchelder, William H. Huse, Susy C. Fogg, Theodora Richardson.

Devoted to the encouragement of the study of Nature in her varied aspects—of the Rocks, the Birds, the Flowers, and all the multitude of living things that crawl or swim, or walk or fly.

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NATURE STUDY PRESS, Manchester, N. H.

Entered as Second-Class matter at the Post Office at Manchester, N. H.

THE MUSKRAT'S WINTER HOME.

NATURE STUDY.

PUBLISHED UNDER THE AUSPICES OF THE

Manchester Institute of Arts and Sciences.

VOL. III. January, 1903. No. 8.

The Muskrat's Winter Home.

BY WILLIAM H. HUSE.

Monsieur Musquash is living in his winter residence. He has been there for two months or more now. All summer his domicile was subterranean. It was cool and comfortable. With his entrance below the surface of the water he was comparatively safe from most of his enemies. There his little family was reared in the spring. It was a satisfying occasion when all the young people had become expert in swimming and in getting their own provisions. From that time till cold weather, life came near being a picnic. It need not be supposed there were no frights and no escapes from enemies; but these were soon forgotten. The fields were full of clover. The trees were dropping their apples, and carrots and parsnips grew in a nearby garden. Living was cheap and luxurious. It only lacked the dream. Nightly excursions to the commissary made a path leading away from the bank near the entrance of his home and branching to the clover, the sweet apples and the garden. How sweet those apples were!

The frosts came and our friend's coat grew thicker. Had he lived farther away from a city he would have been

in more danger from traps, but the boys of his neighborhood knew little of trapping, and he lived in peace. As the days and nights grew cooler, he was impelled to change his residence, Was it instinct or reason that moved him? I cannot tell, but I suspect the former had most to do with the impulse. He did what his ancestors had done in times of high water ever since they lost the shelter of the ark. The water was getting high in his little home, and the floors were continually wet. The meadow where he lived was an old lake plain, now ditched and drained, with a small brook flowing through the middle. A stump in the widest ditch looked attractive, and there a pile of bunches of water plants and grass was made. As it grew in size from the nightly labor, a chamber was made near the bottom with the entrance below the water. Day by day the growing house was watched, but no workman was ever seen there. Enthusiastic visitors examined it and studied its exterior, but it was not disturbed. Today the meadow is overflowed and frozen, and boys use the hard-frozen house for a seat in putting on their skates, while M. Musquash sleeps in safety or makes excursions under the ice for water weeds aud grass roots, unless he has been frightened away by the din of civilization above him.

The house is built high, and I am told that all such houses were built high last fall. The weatherwise predicted therefrom a hard winter. I have an idea that it was the high water in the fall, rather than a foreknowledge of the winter, that caused the muskrat sky-scrapers to be built. We will see.

M. Musquash is unpopular with land owners. He digs through embankments just as if they were his own and he had a right to do as he pleased with them; and he helps himself to whatever he may find as nonchalantly as a barbarian. We should not forget, however, that it was not very long ago that our ancestors were doing the same.

The Ant and the Cricket.

BY EDWARD J. BURNHAM.

One day in August the Boy and I were watching a beautiful striped caterpillar, as it munched away upon a leaf of a scrub oak at the edge of the woods in which we had our camp. The leaf and the caterpillar were scarcely more than a foot from the ground, which in that place was covered by a growth of tall, thin grass, for it was in an old and unoccupied pasture.

As we knelt to observe more closely the process of snipping the bits of leaf, we saw an ant seize a cricket in the grass on the ground beneath. The ant was one of the kind common in pastures in New England, having a black body and reddish or orange head and shoulders. The cricket was the familiar small, black field cricket, evidently a female, as shown by the long ovipositor. Although a small creature, it was many times larger and heavier than the ant which seized upon it.

The cricket struggled desperately for a moment and then apparently resigned itself to its fate, although it was doubtless only awaiting an opportunity to take a strong leap with its long hind legs. The opportunity, however, never came.

The ant stood still for some time, evidently sinking one mandible deeper and deeper between the hard plates of the thorax, and thus securing a firm hold upon its victim. Then the homeward journey was begun—one of the most interesting, if not one of the most exciting, journeys that we ever followed. The grass, of the kind known to the farmer as "white top," was thin in the poor soil of the worn-out and neglected pastures, but the stalks were nevertheless near

enough together to give the ant no end of trouble, as it slowly made way with its reluctant prisoner.

For about a foot the ant tugged along, sometimes pushing its load ahead between the stalks of grass, but for the most part proceeding backwards, dragging the cricket after.

Ever and anon, the cricket's head would pass on one side of a stalk, while the ant had gone on the other, and, after a full stop, it would be necessary to drag the cricket back by main strength and try again. It was slow, laborious work, even when things were at the best for the ant, and, as the journey was likely to be long in point of time if not in distance, we lay prone and watched and waited.

From a human view-point the ant sometimes displayed bad judgment, or perhaps rather lack of what we call judgment. At other times, as we shall see, there was something suggestive of memory and of the lessons of experience. It is probable that for the most part the ant simply followed a trail, blindly retracing the steps by which it had wandered from home. Recent experiments with a device called a "labyrinth" indicate that ants, in their journeyings, leave some sort of trail—possibly a scent—by means of which they are able to find their way back home.

When the ant, with great labor, jerking the cricket to the right and to the left, sometimes tugging it backward and then forward again, had made an advance of about a foot, it came to a stalk of grass which was bent over, the top resting on the ground. Up the straight stem went the ant, dragging the cricket by main strength, to the height of six inches, and then down the sloping portion to the ground again. Fully five minutes were consumed in this herculean labor, and the advance was not more than three inches. But perhaps that was better than the chance of losing one's way.

Some pine boughs had been left by lumbermen, and one lay across the ant's trail, which, apparently, was not so

plain as it might have been. The ant tugged its living load up and down five swaying, bending twigs, without making any progress whatever before it found its way beneath the bough and resumed its journey.

Then succeeded a few feet of uniform advance in comparative comfort, the ant taking a brief rest at frequent intervals. It was during these rests that one could perceive a special use for the characteristic "geniculate" or elbowed antennæ of the ant tribe. The ant, evidently wearied by the firm hold which it had maintained, would place the "elbow" of an antenna closely over the body of the cricket and then withdraw its mandibles. The slightest movement of the cricket, detected by the sensitive antenna, caused the jaws to be snapped instantly in place again. For the most part, however, the cricket remained passive, merely waving its long, slender antennæ in the seeming pathos of despair.

A few feet beyond the pine bough, there was real trouble. Agalena, the grass spider, had her flat web stretched directly across the way which the ant decided to take. This could not have been the way by which the ant came, for the web was entire and undisturbed. That the ant should attempt to cross it is rather against the trail and scent theory; but perhaps the ant, finding its undertaking so great, ventured upon a little independent action of its own. If so, the result was seemingly depressing to the spirit of independence and discouraging to originality. The ant dragged its load straight toward the center of the web. Agalena ran away, as she always does when any serious disturbance occurs, and the ant had nothing to fear from her. But it was desperate work, breaking down the threads and dragging the cricket through the tangled meshes of silk. It was done at last, however, and the ant took a long rest, after which it proceeded deliberately to scrape off the silken threads with which it was encumbered. As for the crick-

et, it was so swathed as to be powerless to make any further attempt at escape. Had the ant deliberately gone out of its way on purpose? Probably we shall never know.

The ant now appeared to resume its trail, for in the remaining portion of its journey it passed the corners of two more webs, but evidently went around to avoid entering them. At one place it climbed a pine bough to the height of nearly a foot, holding the swathed and helpless cricket in its jaws, and crossed to another bough, a distance of three and a half inches, by means of a horsehair—the most remarkable feat of tight-rope walking we had ever witnessed.

This seemed to help out the trail theory, but a few minutes later the ant surprised us by dropping fully a foot to the ground. This certainly could not be because of a trail, whether marked by a scent or otherwise. But perhaps the fall was an accident, and not a deliberate leap downward.

Other ants of the same species now began to be observed with considerable frequency, but they one and all left our sturdy little friend to bear its burden alone—perhaps because it was clearly able to do so. It was evident, however, from the increasing number of the ants, that, after a long, hard journey—for the Boy and I were aching even worse, probably, than the ant itself—we were nearing the nest. The ant had dragged its dear-bought prize to a pile of brush, and we were eagerly peering in to see the finish, when a brilliant-hued Mutilla, or so called velvet ant, which of course is not an ant at all, flashed across our vision. It was of a rare species, and the temptation was great, but our attention was diverted only for an instant. In that instant, however, ant and cricket had disappeared, and they could not be found again, even after the careful overturning of much brush.

The ant's journey, from the time it caught the cricket until it disappeared in the brush pile, occupied just forty min-

utes, and the distance was eighteen full paces, the ant in reality traveling much farther by reason of climbing up grass stalks and pine twigs, and dragging the cricket around obstacles. There were many crickets of the same species much nearer the nest which apparently might have been secured with less trouble, but perhaps the ant had reasons of its own for making its selection.

When we had rubbed our knees and elbows, and rested our backs a little—for close and continuous observation is tiresome work—we returned to our camp and carefully wrote out in our journal the notes that had been made afield during the progress of the journey, and from which this true story has now been told.

Singing School For Thrushes.

A writer in *Forest and Stream* tells us of the methods the thrush adopts in teaching his little ones to sing.

"Find," he says, "a family of the thrushes and carefully note what takes place. The old male thrush will sing the sweet song in loud, clear, flutelike notes once and then stop to listen while the young birds try to imitate the song. Some will utter one note, some two. Some will utter a coarse note, others a sharp note. After a while they seem to forget their lesson and drop out one by one. When all are silent the old thrush tunes up again, and the young thrushes repeat their efforts, and so it goes on for hours. The young birds do not acquire the full song the first year, so the lessons are repeated the following spring. I take many visitors into the woods to enjoy the thrushes' singing school, and all are convinced that the song of the wood thrush is a matter of education pure and simple."

Nature Study Lessons. VIII.

BY EDWARD J. BURNHAM.

While the terms "evolution" and "natural selection" still have a somewhat formidable appearance, even to many grown people, the fundamantal principle is so simple, as in the case of most great truths, that a child can readily comprehend it. All that is necessary is that the child shall have a little guidance in seeing with its own eyes and in thinking in its own way.

The average child, old enough to take walks abroad, will readily perceive that if every pair of birds reared five young, there would be seven birds in autumn where there were two in spring. In order that there shall be only the same number of birds always, five in seven must perish each year. Nature has provided for this so delicately that one rarely, almost never, sees a dead bird in field or wood. Of course, when man goes to killing birds, too, it disturbs Nature's plan, and all the birds are in danger of destruction.

In Nature's way, the birds that are most easily seen are most liable to be caught, unless they have some other advantage, as swiftness or courage; those that have the sharpest eyes are least liable to starve; those with the sharpest and strongest claws can climb and scratch and tear to the best advantage. Those that are less fortunate must die. So it has come about that there are birds colored like the greens and yellows and reds of summer; blue birds, like the sky; brown and gray birds, like dried leaves and the trunks of trees.

Among plants, this "struggle for existence," is much more intense than among animals. Millions of seeds ripen where only a few can find a place to grow. Plants are at a disadvantage in that they do not move

about. They must have some way of scattering their seeds. Some open their pods with a snap, and throw their seeds about; some let the wind take them; some furnish their seeds with hooks, that they may steal a ride, and many hide their seeds in their fruits and tempt the birds to eat them and carry them away. Color plays a very important part here, not for the purpose of hiding, but to attract attention; for many plants must have their fruit eaten by birds in order that their seeds may be scattered far and wide. When we begin to understand this, we are pretty sure to think of

THE PARTRIDGE-BERRY.

Almost every boy and girl knows the pretty and modest little partridge-berry, with tiny leaves that are green all the year round, and bright red berries, which do not fall off when ripe as many berries do. It is very common in almost any kind of woods, and its red fruit may be found all through the winter beneath the snow, and even in the spring when the snow has melted away.

The Mitchella, as the great Linnæus named the partridge-berry, is very abundant, and has been for a great many centuries, but it is of itself a helpless little plant, which would have become extremely rare long ago, or perhaps have perished altogether, if it had not been for the birds. Its stem, which trails or "runs" on the ground, is hardly ever eighteen inches long, and is often less than six. It has to fight its way against larger and stronger plants, and if its seeds all fell where they grew, it would spread very slowly, if at all. Wherever it was too dry in summer, often where the snow changed to ice in winter, the plants would be killed. This would happen year after year, the patches where the partridge-berry had been killed out growing larger and larger, until at last it would be found only in some especially favorable spot, or even

might wholly disappear. But the partridge-berry fed the birds, and the birds have helped the partridge-berry. It is a simple and yet very effective exchange of helpfulness. The partridge-berry holds the fruit tight on its tiny stems until the birds find and eat it and fly away to scatter the seeds through the woods, among bushes in the pastures, and, indeed, almost everywhere. The more partridge-berries there are, the more birds can live through the winter; the more the birds scatter the seeds, the more partridge-berries there may be; and so the mutual helpfulness goes on year after year.

Now we see why the partridge-berries are not allowed to fall off, and why they are so bright red when ripe, and why the leaves are always green beneath the snow or under the dead brown leaves of trees that sometimes cover them. Little Mitchella often hides, but she wears a green dress, that the birds may find her, and she offers them a good meal whenever they are hungry. She does not *know*, of course, but it is the very best thing she could do, for herself and her own kind, as well as for the birds. Kindness and helpfulness often work this way; but that is another sort of lesson.

The checkerberry, or wintergreen, is another example of a plant with leaves persistently green and with red berries, which depends upon the birds for the scattering of its seeds. In both partridge-berry and the checkerberry the fruit is "good to eat" as soon as it is ripe, and is not changed by the hardest freezing; but there are many plants, especially among the shrubs and vines, which bear bright-colored berries that are distasteful to our summer birds, and are left by them when they go south in autumn. These hard, sour, bitter or acrid berries remain until the frosts have mellowed them and improved their flavor somewhat, when they are quite acceptable to winter birds, who cannot, if they would, be so fastidious as their summer

cousins. It adds greatly to the interest of a winter ramble to observe these berries, still clinging in clusters to the stems on which they grew, and to notice the bright colors they put on, as if tempting the birds to eat them.

The bright scarlet berries of the black alder and the darker red berries of the high-cranberry are familiar to everyone, as are the round red berries of the holly, which is brought from the southward in such great quantities at Christmas time. The strawberry and the raspberry are excellent examples, among summer fruits, of this use of color by plants to attract birds and secure their assistance in the distribution of their seeds. The seeds of some plants, as the dandelion, have wings of their own, and can fly far away on the wind, but many others make use of the wings of birds.

There is a true reason for everything, if we could only find it, and we may find out many things for ourselves by looking sharp and thinking about what we see, just as we have now found why strawberries and partridge-berries and many other berries and fruits are red.

To see all our birds in their winter homes we should have to travel from the Middle States down to the Argentine Republic. We could see many, though, by making a midwinter trip to the Gulf States. In Florida, for instance, we should find enormous flocks of robins whirling through the trees and alighting here and there to feed upon the berries of the china-tree and holly. Many birds we should find only along the coast, and many others we should have to search for in the silent cypress swamps of Louisiana and Mississippi. The herons love the solitude of these swamps, where in the numerous springs and streams they find the fish and frogs on which they feed.—*Woman's Home Journal.*

A Useful Family. III.

BY FREDERICK W. BATCHELDER.

There was a time in the morning of the world when plants were very much alike and were very evenly distributed over the globe. Gradually, changes in physical conditions brought about differentiation and unequal distribution. So it has come to pass that the plant world as we now behold it is divided into well defined groups and the several groups are more or less restricted to definite areas, zones or climates. For convenience we call certain groups orders and families. We speak of the orchid family and the grass family. It so happens that the grass family is a very characteristic one; that is to say, it possesses characters which distinguish it perfectly from all other families. The same is true of the orchid family.

There must, then, have been a time when the grass family succeeded in attaining its majority, so to speak; when its place and its mission were allotted. To the same order, according to the present system of classification, belongs another great group of plants, the sedge family, with about 3000 species, one genus alone, Carex, having not less than 1000 species. Both these families doubtless came originally from the same stock, but in the course of ages the grasses took on a type essentially different from that of the sedges. This difference is of vital importance, and the acquirement of it may be called the greatest event in the development of the vegetable kingdom, to be ranked with the evolution of man from ape-like ancestors.

To the unpracticed eye grasses and sedges look very much alike. Especially are the members of the genus Carex likely at first to be mistaken for grasses, and they are usually called grasses. The cows know better, and will

eat them only when they cannot get grass. These sedges make very poor fodder, and so the farmers chop them and mix meal with them to tide over the trying season between hay and grass. Nearly all the sedges are wiry, hard and dry, and lack the nutritive elements which the grasses abound in. In their stems and leaves, then, the grasses are infinitely superior, so far as regards usefulness, to the sedges.

Important as this character of the family is, there is another character of at least equal importance. Man cannot conveniently eat grass. Neither his teeth nor his digestion are adapted to that end. The fact that the grasses are essential to the welfare of flesh and milk producing animals is one of tremendous importance to the human race. No less important is the fact that grasses produce seeds which abound in nutritive matter. When the sedges and the grasses separated from the ancestral stock and from each other it so happened that the two groups had adopted quite different ways of developing their fruit. Every plant that went sedgeward produced a hard, bony seed containing little or no nutritive matter; every plant that went grassward produced a *grain*. This is a little word, but "O, how mighty!" A grain! Botanists call it a "caryopsis." No other family of plants yields a fruit like it. The little embryo is placed at the base on one side of a mass of farinaceous matter, formerly called "albumen," now more properly named "endosperm." It is this tiny mass of floury matter that feeds the world! Some species of grass which produced abundant or large seed were used as food untold ages ago. One after another the well known cereals were discovered and improved by cultivation. Of the barley tribe three members have become staple food products, barley, rye and wheat. The rice tribe and the oat tribe and the maize tribe have each made contributions of more than secondary importance to the food products of

the world. So the seed, which is valueless in the sedge family, is of paramount importance in the grass family, and it is no exaggeration to say that in the vegetable world grass is king.

The attainment of this eminence by the grass family has not been aquired without some sacrifice. The flowers are small, inconspicuous, irregular and incomplete. Yet there is sufficient evidence that originally they were regular and complete and followed quite closely the type now seen in the lily family, where there are three outer sepals, three inner sepals (or petals) three outer stamens, three inner stamens and a pistil with three carpels. This, it may be remembered, was also the plan of the primal orchid flower, and appears to have been the general plan of the flowers among the monocotyledons. The grass flower is at present very different from the original type, more than half of the parts having suffered elimination or reduction. The three outer sepals have been suppressed; the three inner sepals (or petals) are now usually represented by two scales called squamulae or lodicules, though occasionally there are three of these and sometimes none; the three outer stamens usually remain, though sometimes one or two of these are suppressed; the pistil has lost one carpel, so that now it is bicarpellary. So there remain in the typical grass flower of today the pistil, three stamens and two lodicules. The flower is perfect, for it takes only a stamen and a pistil to make a perfect flower. The whorls of perianth leaves, those organs which usually protect the delicate reproductive apparatus, are practically lacking. The stamens and pistil, are not, however, without protection. The office usually performed by sepals and petals is committed to bracts, which completely envelope the flower until the time oi inflorescence.

One cannot help thinking that these changes in the flower have been brought about in the interest of economy

and that the value of the plant has been enhanced thereby. Pollen is produced in abundance, the wind is ever waiting to distribute it and thus to favor cross-fertilization; and insects also lend their aid to the same end. Parts which were not essential to the well-being of the family have been one after another disposed of, and thus more of energy has been conserved towards the secretion of nutritive elements in the plant as a whole and the development and protection of the precious seed. The stamens and pistil have undergone some remarkable and beautiful changes. The anthers are hung by the middle on slender filaments and vibrate in every passing breeze. The two stigmas are variously shaped in different genera and are exquisitely feathered. Under the lens the flower, when at its best, is a thing of rare beauty.

Geography As It Is Learned.

BY WILLIAM H. HUSE.

A recent set of test questions given to a geography class brought forth these gems along with a much larger number of answers more prosaic and more in accord with the findings of science.

Among the proofs given of the rotundity of the earth were these, by two pupils:

"When Columbus first set sail if an object could have left the sky and have gone 25000 a day towards the earth and when Columbus landed it would still be many miles away from the earth."

"When Columbus set sail he declared that the was round and he told the people if the wanted a proof to take and egg and try to make it stand on end. They found that they could not unless they broke the end and so they gave in to Columbus that the earth must be round."

These two definitions of a glacier with a statement of the relation between a glacier and an iceberg are of value:

"A glacier is a outburst of water which springs up out of the earth. A glacier comes out of the ground and springs up in the air while a iceberg lays flat as it scours the earth."

"A glacier is ice that is formed for years and doesn't melt quickly, it takes a long while to form a glacier. Glaciers help to change the face of the earth by the means of being formed so long and after being melted forms the earths surface smooth. The difference between an iceberg and a glacier is that an iceberg will melt quickly and a glacier will be formed a long while."

The direction to mention three river systems and state what a river system is, brought the following:

"Cascade Range.
Serri Nevede.
Coast Range.
A river system is a range of mountains that extent from a larger one range."

The next two selections speak for themselves:

"Latitude tells wether the earth is it the cold or hot belt. Longitude goes the other way."

"The shape of the earth is a triangle. It is bounded on the north by the Artic Ocean, on east by the Atlantic Ocean, On the southe Gulf of Mexico. On the west by the Pacfic Ocean."

This gem answered the question, How do the sun's rays fall on the hottest belt of heat?

"When the sun rays fall the hottest on the belt its rays come sliding down."

These answers, of course, are exceptions. They make very interesting reading and after the risibilities subside the question rises, Why? The answer is not difficult. The few who gave these answers (one immature mind is responsible for five) have been committing words to memory.

They have seen nothing but the words on the printed page, and, as is natural, got the words mixed.

Little better off are those who can recite glibly the words of the book but who have seen nothing more. They make a good showing before visitors and are marked high in daily recitation. If their memories are good they will get a good per cent in examinations, but they are not being educated.

A pupil recently told me in recitation that the exports of a certain section of Africa included indigo and gums. Most the class were ready to attest the same fact, and yet not one had ever seen indigo, but few knew what it was used for and not one had any idea what gums were found there. One boy diffidently suggested spruce gum. The entire class has now seen indigo, gum arabic and gum myrrh, along with copal, sandarac and crude rubber that come from other sections. Without such knowledge, it is time wasted to commit words to memory. It is not education. Yet we teachers have wondered in the past why so many pupils called geography dry, and why all forget it so soon.

The remedy lies along the lines of nature study and laboratory methods so far as possible. Geography work in the future is to be experience with things rather than words. Knowledge is to be gained directly from specimens and pictures, and then the printed page will mean something.

Humanity, delighting to behold
A fond reflection of her own decay,
Hath painted Winter like a traveller old,
Propped on a staff, and through the sullen day,
In hooded mantle limping o'er the plain,
As though his weakness were disturbed by pain;
Or, if a juster fancy should allow
An undisputed symbol of command,
The chosen sceptre is a withered bough,
Infirmly grasped within a withered hand.
These emblems suit the helpless and forlorn;
But mighty Winter the device shall scorn.

—*Wordsworth.*

The Beetle Family.

ALBERT LEA, IN ORANGE JUDD FARMER.

What is that flashing jewel that scampers across the dusty road? It must be an emerald, it is such a splendid, shining, green color. Let us go closer and look at it, softly, softly. Ah! it hears us and is off, and flying above our heads when we are still a yard from the spot where it was resting. It it too small for a bird, and butterflies never run. Can you guess what it is?

A beetle, the beautiful tiger beetle. The beetle family is a very large one, and there are some of the cousins, and uncles and aunts or sisters or brothers in every country in the world.

We all know how the cunning little lady bugs, red and black, that fly away home when we hold them on our finger tips and tell them that their houses are on fire and their children will burn.

The big brown dorbugs that come in and fly about the lamp in the evening, with a loud humming noise, are beetles, and so are those splendid golden fellows we call June bugs.

Sometimes when you are walking along beneath the trees perhaps you will meet a stag beetle with his fine large horns.

If you come across a dead bird or field mouse lying on the roadside, you must turn it over and see the burying beetles at work.

They are very busy creatures and very useful to us because as soon as any little animal dies they gather round it in great crowds and dig out the earth from under it until there is a hole deep enough for it to sink down into. Then it is carefully covered up, and when they are hungry they go where there is a hearty meal waiting for them.

There are beetles that live in the ponds and brooks, too.

They are called whirligigs and boatmen, and are fine divers and swimmers.

All the beetles have hard, shining coats of mail. These are only the covers to their wings, and when they want to fly they open the wing covers in the middle and spread out their soft, gauzy wings that they keep folded up underneath.

Pioneer of Plants.

Lovers of outdoor life have only good words for that strong-scented denizen of swamps, the skunk-cabbage. This plant, hardy, brave, undaunted in any weather, breaks the ice about it even in January, and the careful observer may find it at that unpropitious season already making its preparations for the spring. The author of "The Brook Book" says:

"One cold day in early February, I was prowling along the underbrush near my favorite cabbage patch, when I became aware that some one else was also crunching about in the snow there. This person, dressed like myself in short skirt and heavy boots, was intent on some odd business which I could not at first determine. She was bending down, thrusting her hand into the snow, and I could see that she held some small gleaming instrument. It proved to be a thermometer.

"'Good morning!' said I. As she returned my greeting, she thrust the thermometer down into an opening in the snow.

"'May I look?' I asked, suiting the action to the word.

"The opening in the snow had not been made by her hand, as I supposed. It was rounded smoothly, and down at the bottom I could see the top of a skunk-cabbage hood.

"How came the air-holes there? What did the thermometer mean? I looked inquiringly at my new friend.

She showed me that some of the openings were small, and others as much as eight inches across. In no case was the hood of the plant on a level with the surface of the ground. In the larger ones the cavity was widest at the bottom, the snow walls forming an arch over the top.

"While we were talking the thermometer had been registering the temperature of one of the plants. She gently drew it forth and read its record. This she jotted down in her note-book against the date. She then let me look at her notes.

We found that the temperature of the plant was, in many cases, considerably above that of the atmosphere. The largest difference between the two was four degrees, Centigrade, or seven and one-fifth degrees, Fahrenheit.

"'I thought when I first noticed those holes,' said she, 'that the skunk-cabbages must be at work generating enough heat to melt the snow around them. Now I am sure of it. I have visited this place every day for a week, and my record shows that the plant not only keeps from freezing itself, but is able to melt out a breathing-hole besides.'"

A scientific writer has recently explained that the sense of gravitation in plants is that sense that makes a pine tree grow straight upward. A plant that curves assumes that position because its sense of gravitation makes it take the one best suited to its needs. Some flower stalks are very curiously guided by the gravitation sense. The narcissus is an example. At first there is a straight shaft, piercing the ground with its compact pointed flower bud, but as the flower opens, the stalk bends close to the top and brings the flower tube into a roughly horizontal position, where it shows off its bright colored crown to attract the insects, on the visits of which it depends for fertilization. the flowers are guided to the right position by the gravitation sense, and they increase or diminish the angular bend in their stalk until the right position is attained.

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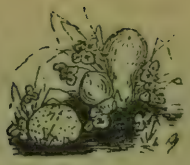

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A monthly magazine, published under the auspices of the Manchester Institute of Arts and Sciences. EDITOR: Edward J. Burnham. ASSOCIATE EDITORS: Frederick W. Batchelder, William H. Huse, Susy C. Fogg, Theodora Richardson.

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Entered as Second-Class matter at the Post Office at Manchester, N. H.

"A rocky gorge named by the orthodox settlers Devil's Pulpit."

NATURE STUDY.

PUBLISHED UNDER THE AUSPICES OF THE

Manchester Institute of Arts and Sciences.

VOL. III. February, 1903. No. 9.

Home Physiography.

BY WILLIAM H. HUSE.

The old geography was a compilation of facts to be memorized without regard to what caused them—so many miles, so many people, so many tons or yards, so many states or countries as bounds; the new geography is distinguished by its account of the processes that have made the world what it is and are at work to-day. This is the cause of the complaint from those not yet weaned from the old things that there is too much physical geography in the new books and that political geography is crowded out. It is evident to those who have observed and was plain to those who made the new books that children are more interested in physics than in politics.

Yet with nothing but books the childish minds do not study physical facts but words. It is easier (for the teacher) to confine the lessons to the textbook but that is not education. The words are committed to memory and good per cents are sent home to admiring parents and shown to parental committee men, but the children have been robbed of all their innate love for nature and it is seldom recovered.

The same forces that are described as working in foreign lands are working in our own. Many are busy in our own town and the features illustrated in the textbooks are often within sight of the school house. These are just as interesting to the pupils and give life to the book. The physical features here described happen to be near Manchester and are doubtless unknown to all but a few of the many teachers that read NATURE STUDY, but they are given merely as types of features found everywhere.

Ponds and lakes are common, especially where the ice-sheet ploughed its way and gouged out basins that now are filled to the brim by springs and brooks. Lake Massabesic is one of these. Lying partly in Manchester and partly in Auburn, it fills the valleys that wind about between rocky and gravelly hills and is one of the beauty spots of southern New Hampshire. At no place very wide, its shore line measures thirty miles. Overflowing its brim at the lowest point, its waters rush down to the Merrimack river, turning on the way the wheels that pump a portion into Manchester for the city's use. The ancient valleys can be traced in their courses almost as easily as before they were drowned. In this and similar lakes, accessible to nearly all, many features of land and water are found and those fortunately near them have the best illustrations of their text books.

In the northwest corner of the neighboring town of Bedford is a rocky gorge that was named by the orthodox settlers Devil's Pulpit. In these liberal days the first half of the name is dropped. At the head of the ravine the rock shows the effects of water carving somewhat unusual in this section. The place is a Mecca for picnic parties, but has a greater interest for the geologist. A small brook tumbles noisily down over the rocks, diminishing in summer to the merest rill. The carving was done when the valley was filled with a torrent many times larger than any

in New England today or perhaps before that, when water brought to life and motion by the summer sun poured down through a moulin in the ice-sheet that covered the land.

In the dried bed of some small river we often see ridges of water worn pebbles, large and small, that have been deposited by the water in springtime while the sand and silt were carried further along. Similar pebble ridges are sometimes found in valleys where no water has been seen within the memory of man except the brook that meanders from side to side and carries its burden on to the river and the sea. Such a valley with such pebble ridges is the one through which Black Brook flows on its way to the Merrimack at Manchester. Here a farmer has his cornfield in the bed of a post-glacial stream and sturdily hoes his corn where once the mighty torrent rushed. It is not the owner of the corn who is represented in the illustration, but one more interested at that time in geology than agriculture who consented to pose as the man with the hoe.

Thus are our fields filled with physiographic features of interest and value. It happens that nearly all such in this vicinity are a legacy from the ice age. Many more are worth mentioning but they will do for another time.

Mocking-Birds in Connecticut.

Mary Hazen Arnold, whose writings are appreciated by a large circle of readers, in a letter to the editor of NATURE STUDY, asks:

"Have any of your readers seen the mocking-bird as far (or farther north in Connecticut) as Waterbury? I saw one here among the trees skirting the Naugatuck river several times during the last week of July last, and while South this winter at once recognized the bird as the visitor of last summer. I have known of the bird nesting near New Haven—but have not heard of its coming as far north as this. 'I shall watch for its coming next summer.'"

A Useful Family. IV.

BY FREDERICK W. BATCHELDER.

The grasses which are called cereals are of primary importance to man, since they supply those seeds or grains of which his daily bread is made. Second to these only in value are the forage and pasture grasses, both wild and cultivated, which furnish subsistence to the herbivorous domestic animals. Yet these two, though the greatest, are not by any means the only contributions of the grass family to the well-being of man.

While all the members of the family are botanically similar there are enormous differences in size, aspect and habit between them, differences we in the north can scarcely appreciate until we have become acquainted with the grasses of the tropics. There is one genus, Bambusa, bamboo, of which the plants in several species attain tree-like dimensions.

They actually form forests of somewhat palm-like trees forty to eighty feet high, or even higher. A. R. Wallace, in his work on the Malay Archipelago, pronounces the bamboo to be "one of the most wonderful and most beautiful productions of the tropics, and one of Nature's most valuable gifts to uncivilized man." The uses to which this giant grass can be put are practically numberless. It serves the natives in some way or another at every stage of growth and in every part, The young shoots are served like asparagus, and are also eaten salted or pickled or candied. Joints of the stem are made useful as water buckets and bottles and drinking cups, or even as cooking vessels. When a native wishes to build a house, he may, if he chooses, make it entirely of bamboo. Large stems are used as posts, smaller ones as rafters, still smaller ones as lattice work for the walls and as thatch for the roof. The house

thus literally made of grass is both strong and durable. When furnishings are required there is nothing superior to the wicker work beds, chairs and divans woven with Oriental deftness from the same material. Then for every-day emergences there are bows, arrows, buckets, paper, and even pens, to be obtained from this never failing source.

The stems of bamboos are slender, not usually exceeding in diameter one per cent of their height. Their rate of growth is phenomenal, sometimes not less than two feet in a single day. At that rate it must surely be possible to hear them growing!

If the bamboo is the most useful of all grasses to uncivilized man that grass which, next to wheat, is of the greatest value to civilized man is Saccharum, sugar cane. This is a large grass eight to fifteen feet high, one to two inches in diameter, which originally came from India and China and is common in nearly all tropical and sub-tropical regions. From it is derived at least one half of the world's supply of sugar, and much the better half, for in quality and taste cane sugar is superior to that made from the beet and other sugar producing vegetables. The sweet juice constitutes ninety per cent of the weight of the stalk, the amount actually extracted being from sixty to eighty-seven per cent. About fifteen per cent of the juice is sugar. Twenty tons to the acre is considered a good crop of cane.

The sugar cane was introduced by the Spaniards into the West Indies in 1494, and has ever since been and still is the most valuable product of the islands. It is no exaggeration to say that the prosperity of the Antilles has been dependent upon the cultivation of this one species of grass.

It is not pleasant to reflect upon the misery which for nearly four hundred years followed in the track of the sugar planters. By the time plantations were established

throughout the islands the native population had been nearly exterminated by the oppression and cruelty of the Spaniards and it was impossible for the planters to carry on a profitable business for lack of hands to do the work. So the practice of importing slaves from Africa was begun and favored in every way, and negro slavery was firmly established on the American continent, even in the most enlightened sections. History records the consequences, and the end is not yet.

Among the grasses called millet have been included many and diverse kinds. The Indian or Turkish millet, Sorghum, is one of the most important of these. In some parts of the world it takes the place of oats and barley, being nearly as prolific as maize (Indian corn). It sometimes grows to the height of twelve feet. The grain, though abundant, is of inferior quality. One species, the so called Chinese sugar cane, has been introduced into our western states and has been extensively cultivated. It was at one time expected to become a rival of the sugar cane. Unfortunately the juice derives its sweetness mostly from glucose, so that the product is far less valuable than that obtained from the true cane. Large quantities of molasses of an inferior quality are made from the expressed and concentrated juice.

The true millet is a member of the genus Panicum, the largest genus in the family. Probably the most ancient millet was *P. miliaceum*, a rather large but handsome species, occasionally cultivated hereabouts, but oftenest found as an escape by the roadside or on dumps. The grain is large and is supposed to have been one of the earliest used in bread making. It was cultivated in southern Europe more than two thousand years ago, having been brought thither from India, where it had been in use for unknown ages before.

With the mention of the cereals for bread, the forage

grasses for fodder, the giant bamboos for the making of anything from a writing pen to a house, and the sugar canes for the manufacture of numberless luxuries, one might think the enumeration of uses must be complete. Not so. There is still another value to be noted. The stems of certain grasses are of very great use to man in various ways. Especially is this true of the stems of cereals, for they supply the straw which is so largely used in manufactures. So important is the production of straw of good quality that experiments are constantly being made by the mixing and crossing of different races of wheat to evolve a stem of finer quality. Common straw-hats, leghorn bonnets, fancy baskets and mattings are some of the more familiar examplas of the use of straw.

Considering the great size of the grass family and the immense diversity of its members the fewness of species which are in any way injurious or even annoying to man is remarkable. There is but one local species which can be called a pest. This is the hedgehog grass (*Cenchrus tribuloides*), a low coarse grass growing on or near river banks. The fruit is inclosed in a prickly involucre which adheres persistently to clothing or to the hair of animals and is removed with difficulty. It must be very annoying to cattle. Fortunately it is not common enough to do much harm. Another grass abundant in the west has recently been introduced eastward which, if it should become common, might be a serious pest. This is the squirrel-tail grass (*Hordeum jubatum*), one of the most beautiful of grasses to look upon. It is a wild barley, and, like cultivated barley, has long bristles or awns. These are exquisitely iridescent, but they are also finely barbed, and when eaten in quantity by cattle cause choking, not infrequently with fatal consequences.

As a rule the quality of a grass is indicative of the quality of the soil in which it grows. The most useful grasses

are annuals and require a rich soil and more or less cultivation. A wiry, poor grass denotes a poor soil. The poorest grasses of all are those of marshes and wet meadows.

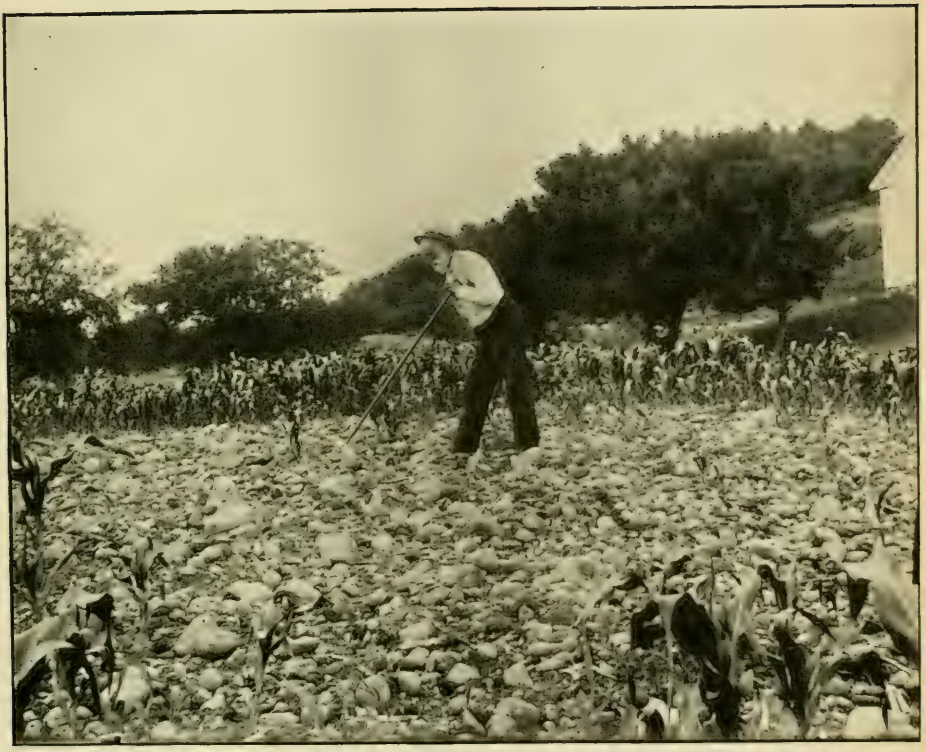
A good habitat for a sedge is pretty sure to be a bad habitat for a grass. The tendency determined ages ago at the parting of the ways between the two families is still manifest.

Animal Life in Literature.

BY CHAS. J. STAPLES.

Literature does not look upon animals with the exactness of science. Literature is an artistic reflection of life in all its varieties and relations; and human thoughts about the animal world, the way in which these other creatures affected men, have left some mark, however slight, upon the writings of all nations. We may distinguish several stages in the representation of animals in literature, certain changes in man's mental attitude toward these other inhabitants of his world.

In those remnants of primitive literature called folk-lore we find a most interesting use and portraiture of animal life. It is the faint and twilight reflection of an older age, when beasts and men were closer in their ways and needs and natures. In the folk-lore tales animals play almost equal parts with man. There is a warm companionship between them, whether as friends or enemies. The border-line between the beast-world and the man-world is left, half-unconsciously, dim and vague. The imagination has no difficulty in passing over it, just as one may observe the children doing now. At one moment the animal, bear, rabbit, fox, is endowed with human desires and motives; the next he is even raised beyond humanity in power, wisdom and insight. He becomes a supernatural



"A farmer hoes his corn where once a mighty torrent rushed."

being. The spirit of the animal race and species becomes a guardian or a hostile spirit, with influence upon the fortunes of men. In this wonderland of the animal world all things are possible, There is kinship between man and other creatures. There are ways by which they may understand each other. The beaver, the crow and many others become totems, mystic ancestors and protectors of certain families and associations of men. This is a strange and wellnigh incomprehensible attitude now, but there was a warmth of feeling, a certain beauty, a kind of fearless innocence in it, too. The relation between animals and men was simple and hearty.

Out from these naive and childlike tales of early folklore springs the fable. But there is a change. In the fable the animal is, as it were, degraded from his older position as an associate and confidant of man. He becomes a mouthpiece of human cunning. He is artificialized, conventionalized. His living qualities as a real animal disappear. The animal name is a disguise. Behind it hides the keen, mocking, prudent, worldly intellect, intent on conveying some stinging rebuke, a sneer, a sarcasm or at best a moral precept that would have small chance of being heard if spoken forthright. In the fable, things are said that otherwise could not be said at all. A vein of shrewdness marks the first development of man away from his animal state. This finds reflection in the fable. The imagination finds pleasure in masquerading and concealing its deeper purposes behind these conventional figures inherited from a former age. And with the fable, in Greece, in India, in Europe, the animal practically disappears from literature. The reason seems to be that mankind, on the way to civilization, cuts asunder that older tie of kinship with living creatures. The oppositions and the differences were emphasized. Intercourse on the old familiar terms was unimaginable. Animals were judged

by their uses. In the Zend Avesta they are sharply divided into good and bad, creations of benevolent and malevolent deities. A distinction is drawn between domestic and wild animals. Only the former furnish occasion for the exercise of sympathy and they but sparingly. The fierceness of the chase, the desire to master, to kill, absorb men's thoughts in relation to the creatures of the wilderness. How few are the pictures of animal life in the classic writers! They were simply like the slaves, of no interest whatever.

Thus was a chasm opened, as it were, between man and his neighbors. Then came the Dark Ages for all creatures within the power of man, and these Dark Ages began before the Dark Ages of Western history and stretched out longer. They were ages of cruelty and indifference, of conscious superiority and contempt. The animal was but another tool for man and whom he willed he smote and whom he willed he cherished. In English literature there are fine descriptions from Chaucer down of the hounds at hunting, of the cattle and sheep, of horses on the highway and in battle, but it is all slight and superficial. These are but the ornaments, the background to human existence. That is the way that Shakespeare treats the dumb creation. And it is not till the opening of the last century that another change begins. You may feel the difference in Burns' lines to the Field Mouse, in Walter Scott's account of his dogs, in Scotch John Brown's fine classic, "Rab and His Friends." This is a new imaginative treatment of animal life. It represents and recognizes the animal as an independent being, as having a psychical life of its own. As childhood is a modern discovery in literature, so is the real life of field and forest. The highest exercise of the imagination is that of putting oneself in another being's place, striving to realize that other creature's view.

This appreciation, this sympathy for the animal, began independently of modern science, but has been powerfully influenced by it. The habit of patient. impersonal observation has recreated the animal world for us. It has done something more than to reduce natural objects to a classified order; it has changed the point of view from one that centers in man, his uses, needs and feelings, to one outside man.

Animals have a different kind of life, a life of their own, and that life has its own rank and value entirely apart from its relation to human life. Therefore must we nothing exaggerate nor set down aught in scorn and pride or supposed superiority.

The third great change in the human attitude toward the animal world as reflected in literature is the recognition of animal individuality, animal character. The description of a species, the anatomy of a vertebrate, does not describe the personal creature. Animals are not chemical products to be analyzed, but creatures to become acquainted with, to be treated respectfully and truthfully. Strictly speaking, science does not cross the line of individual character in animals. Science is interested in the type, in the classified specimen. The nature-student reverences life, is interested in the diversity of the type, the potent and wonderful law of individual variation.

Thus in the very latest developments we are witnessing almost a new creation in literature, a literature of the life in field and forest. We seem to be coming round in the spiral sweep of progress to something of the beautiful, true friendliness which once existed between the human and the animal. It is more perfect and more real; it is a kind of Elder-Brotherhood.

This most delicate and sympathetic form of literature requires high qualities of imagination, patience and restraint. Above all, it requires a fear of that exaggerated

sentiment which reads into the animal world too much of thought and feeling. We want no more personification of animal life, but in humility and reverence to become spokesmen for those fellow creatures who cannot speak for themselves.

A Garden of Sweet Herbs.

BY SUSY C. FOGG.

Long ago, in the old-fashioned gardens, I am told, the fragrant herbs were never wanting.

The stately hollyhocks and the larkspurs, the tall phlox, tne poppies and the sweet-williams were the pride and show of the garden. The red roses were inevitably there, and the spotted red lily that occasionally surprises us as we drive along a country wayside ; usually the outpost or emblem, as it were, of some effort and civilization that had once existed nearby, but all other signs of which have long since fallen in ashes or decay save the door-yard trees or a neighboring orchard.

I have always regarded this same red lily with an unjust suspicion, for I remember being told as a child not to smell of one of them for they would cause freckles ; a thing which I also remember doing at the earliest opportunity, if I may be pardoned for the very personal allusion. If one has not the knowledge, is it not better to experiment when only a few honest freckles are at stake ?

Somewhere in the dear old garden there would surely be a bunch of ribbon-grass or of spider-wort, a plant of southernwood, a sweet-scented geranium, a bed of sprawling portulacas and the ladies' delights in trim little borders of box. Those ladies' delights ! How they flourished in the quaint old town of Marblehead in a bit of sand garden

only separated from the dusty street by a narrow footpath. Every bright little wizened face, and there were many, so strangely in keeping with the hard aspect of the place, smiled a greeting as we passed.

All these flowering plants one could take in at a glance, but there were still others as interesting and useful as they were plain in appearance. How some of them could add to the savor of a dish or could alleviate pain while the country doctor was still miles away!

We could look for the spearmint and the catnip, the sage, the thyme and the summer savory, the bergamot and sweet marjoram, the sweet-grass and tansy with the never forgotten sprigs of "lavender, sweet lavender" and some or all of them would be growing together in grandmother's garden.

It is a fashion now to be somewhat old-fashioned and someone in a city, in the summer that has passed, raised a bed of sweet herbs. The leaves were plucked and dried and used for a sachet. The fragrance is so charming and subtle! Ah! it is said there is nothing like a perfume to arouse old memories, and we are carried back to the days that some of us never knew; where only the imagination can lend a hand.

But we can picture the old-fashioned garden and the prim bonnet and short-waisted gown bending over it fondly, and we love the very outlines of the figure.

Those days were fraught with hardship, exposure and limitations, and not many would turn back the wheel if they could, but it is refreshing in these days of conventional living to contemplate the time when life was simple, pleasures were fewer and people lived more for each other.

If we could all make a garden of sweet herbs it would be pleasant, and, perhaps, we should dream dreams we have never dreamed before.

Nature's Economy in Forms.

BY O. H. LEAVITT.

The circle or the sphere seem to be Nature's ideal in all of her productions. In fruits and vegetables, from the currant to the cabbage and the pumpkin; in the trunks of trees and in the limbs and bodies of animals, with slight variations due to the uses to be made of them, the same idea is shown.

The snowball which increases as it rolls down hill keeps its circular form, and the icicle hanging to the eaves is round, however much it may vary in size at its extremities.

In the case of vegetable growths and the snowball and icicle the form may be accounted for by the fact of a central starting point around which accumulation was made. The circle also represents the greatest strength and least exposed surface for the enclosed area.

The things so far named may be looked npon as the results of construction, but we find that the work of destruction leaves similar results; the pebbles on the beach are worn round, and the hills themselves are being rounded as they are worn away by the action of the elements. Every fragment broken from a rock as it rolls down the cliff is from a projecting corner. The planets themselves are globular in form and turn no square corners in their orbits,

Nature is governed wholly by economy in form for the uses intended to serve. There is no call for economy in space, and the "waste room" between objects is of no account, for we stretch the imagination to the utmost possible limit and the question still stares us in the face: What is beyond that?

The wisdom of the circular form is seen in the case of trees in which the heart wood has all decayed and fallen down, yet a thin shell on the outside supports the tree and

supplies nourishment to the upper trunk and branches. With a tree three feet in circumference and a shell of sound wood only two inches thick, no other form or arrangement of support would serve to hold the tree erect. How long would a slab two inches thick and three feet wide support a tree seventy-five feet high in a strong wind? Yet these hollow trees live and grow and withstand the elements, supported wholly by economy of form.

When nature starts on a rampage and wants to exert its power to the utmost in a limited time and space, the wind is started in a circle and the cyclone results. There is no halt for turning square corners and nothing left to be finished by that which is to follow.

But when we come to the work of animated beings as we see them on the earth, the case is different. The most striking illustration is found in the cells of the bee; a square cell would not fit the future occupant, and circles would leave unoccupied spaces between, while cells with six sides are joined so as to occupy all the space with only the thickness of the wall between. Man would pack apples in square boxes were it not for the fact that the space between the barrels is needed for ventilation.

This is a point where animated beings have to depart from the methods and teachings of nature, and sacrifice form to economy of space on account of the restrictions placed on the latter by competition or by the necessity of protecting all of it that is used.

Man has taken hints from nature's teachings in the construction of tall chimneys and in making iron pipes, finding that both will possess more strength and inclose more space with the same exposed surface than in any other form.

"Ah! my friends, nature is a big-print catechism!"—*Pere Jerome, in Cable's "Madame Delphine."*

Oscar.

BY SUSY C. FOGG.

Oscar is a black and white Gordon setter. In his veins flows the blue blood of pedigree and he is in every way a worthy representative of his race.

He has formed a great attachment for the gentleman in whose family his master lives and is always ready to accompany him on his daily round of business.

One day, the friend was busy at his desk, but the dog was eager to go forth and repeatedly went to the door and waited and listened. Seeing that this did not attract attention he went back and lay head and paw upon the friendly knee. Still it seemed the dog's allotted fate to wait until he bethought himself of one more appeal; to bring a hat and lay it ready for use. Words could not have spoken plainer than his action and the request was heeded.

In going about the city, Oscar once had an experience. His friend entered a house through the open stable and as he was in haste and noticed the dog close at his heels, made the forcible remark, "You wait here!" In leaving the house, he passed through a side door all unconsious of the faithful animal left behind until some minutes later. Even then, the thought was dismissed with another, "Well, he will follow."

Some hours later and long past the dinner hour, there came a summons at the place of business and the mistress of the house telephoned down that there was a strange dog in her stable that would not be driven away. She thought it might be the one that came with him in the morning.

The friend hastened to the spot to find Oscar still waiting for the welcome voice and step that he felt sure would

"Massabesic . . . . . is one of the beauty spots of Southern New Hampshire."

return. His dogship was ready to trust and obey orders wherever given. Could a soldier have done better?

Sapsuckers.

Editor of Nature Study:

I was pleased to find, in the December number of NATURE STUDY, that investigation by admitted authority had settled the fact that at least one of the woodpeckers really taps trees to get the sap to drink. This fact has long and persistently been disputed by people who were credited with close observation and accuracy of statement. I have had apple trees killed by being girdled by these birds, and have watched them day after day while working near them in the orchard, and seen them go from one hole to another and drink out the sap, and when the holes dried up, drill a new row. There are few trees in our forests exempt from their attacks, and the marks of their work are often seen in logs cut for lumber, where the injury was not enough to kill the tree. It is a noticeable fact in forests of large hemlocks that nearly all of the trees have lost their tops, and close examination will, in most cases, show the work of these birds where the break occured.

The writer referred to plainly states that another species drinks the sap from the holes, and it would be no more surprising than some revolutions in what had been accepted as "science" if it should be learned that the original injury is not all done by one species.

I am glad the wedge has been started. Solon Robinson, in his Facts for Farmers, solemnly declares that crows do not pull corn, but only disturb it while digging for insects. We have writers of later date who would have us believe that certain hawks will refuse a chicken and catch a squirrel or a partridge.

If the study of nature, in practice or in publication, results in showing how many things are "known" that are not so, the ground will be cleared for the acquirement of actual facts. One trip to the forest, or one visit of a bird to the orchard does not furnish data sufficient for a declaration of the usual habits of the bird or animal under consideration.

O. H. LEAVITT.

Manchester, N. H., Jan. 20.

Catching of Lizards.

There are probably very few persons in New Orleans who have not seen the little green lizard that hangs about the trellis or the rose bushes. If they knew that in the category of science he was *Anolis Carolinensis* they might have suspected that he was named for his tail. If he dropped his name as easily as he drops his tail, there might be many cases of mistaken identity to record. This readiness to leave his posterior member behind him is a very important item in the economy of lizard catching, which has become a very extensive industry in New Orleans. The chameleon, as he is called, has many points about him that have rendered him attractive or conspicuous, and the demand for him in sections of the country not lying near the eastern and central part of the Mexican Gulf has been steady for some time.

The changing of colors is perhaps the habit of the chameleon that has rendered him most attractive to the lovers of the curious, though his docility has also helped to place him in the category of pets. The changing of color is an altogether voluntary affair, and is performed for protective purposes. Many birds, while they are of a color that accords with their commonest surroundings, are often exposed by their presence in some other surroundings. But the remedy for them in such cases is simple; they need merely fly to the surroundings that protect them. The chameleon, however, not being able to get as rapidly from one environment to another as the birds, takes the precaution to work up as quickly as possible to the shade of the particular surface on which he rests. From clear green to a muddy dark brown there are many shades through brown, olive brown and olive green. There is no one of these that the chameleon cannot assume for himself.

As an insect destroyer the chameleon is unexcelled. There has been some rumor latety to the effect that the dealers who ship lizards from here take advantage of this fact, and that large shipments of chamaleons are being made to California to rid the fruit orchards of insects. When asked about this matter recently, most of the bird and pet dealers professed ignorance of the matter, though at one store it was learned that large shipments are made to California as well as to other parts of the country. Those vouchsafing the information said they did not know whether dealers in California to whom the lizards are shipped sold them for the purpose of destroying insects. At all events, great numbers of the little reptiles are

constantly sent out of New Orleans. The dealers here buy them for one dollar a hundred, and in sending away large quantities they double the cost. Single specimens sell at ten cents. The reporter was shown a consignment of 500 that were to go to Philadelphia. They were caged in an ordinary dry goods box, with netting on one side. Wet sponges were put in the box. The percentage of deaths when the chameleons are shipped with ordinary experience is seldom over ten per cent. Before being sent away the lizards are kept in large bird cages. In that case the percentage is about one, not counting the death of those injured in being caught.—*New Orleans Times-Democrat.*

Nature Study Lessons. IX.

BY EDWARD J. BURNHAM.

Of course you have often noticed a hollow ring in the snow at the base of a tree. February is the best month in the year for observing these rings. It is evident that the snow has melted faster close to the tree than a few feet away. Why? Perphaps you have thought that the tree was or had been warmer than the snow; and you were right. But why? You might think it is because the tree is alive; but dead trees, and fence-posts, even the dried mullein-stalks in the pastures, have these circular hollows around them, if the sun has been shining for a day or two. Immediately after a snowstorm, the snow is level or perhaps even piled up around the trees, fence-posts, mullein-stalks and similar objects. After a day's shining of the sun, however, the snow begins to melt again.

The heat of the sun is absorbed more readily by dark-colored objects than by those that are white. The snow melts but slowly even under the rays of the sun, but the trees, fence-posts, mullein-stalks and such objects gather the heat when the sun shines, and then, giving it out again, melt the snow around them. The same thing happens when honey bees fall in the snow and die, as they

often do in February and March. The black body of the bee gathers the sun's heat, and then melts the white snow faster than the sun itself can do.

Another very interesting thing to do on a walk in February is to look for such birches as still hold their countless seeds tied up in slender packets, which often hang so densely upon the twigs as nearly to cover them.

Some of the birches let the wind blow their seeds away early in the winter, but many still remain, and I know a little boy and girl who think it great fun to keep a sharp look-out for them. When one is seen, they go scrambling through the snow to give the tree a hearty shake, laughing and shouting to see the tiny seeds float away in clouds or fall in showers around them.

These packets of birch seeds are very interesting in themselves. Scarcely an inch long and no larger than a slate pencil, they hold thousands of seeds, so flat and thin and light that, when loosened and set free, they float in the air like tiny birds. But they cannot float away when they please, for they are held tightly together by a little thread or scale or point at the upper end. As soon as this is broken or loosened, however, sometimes by the wind swaying the branches, sometimes by the children shaking them, sometimes, perhaps, by the birds pecking at them, the entire packet becomes undone and away go the seeds, to be scattered far and wide, many of them to grow into little birches along the roadside, in the pastures, and at the edges of the woods. It is one of nature's many ways of sowing seeds.

Gather a few of the packets carefully and carry them home in a box. If they are damp, dry them gently ; then try to pick out one of the seeds, and see how they all fall into a powdery mass in your hand. Then examine some of them with a lens or under a microscope. It is a capital nature study lesson, but the most fun of all is romping through the snow to shake the trees.

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Nature Study...

Vol. III MARCH No. 10

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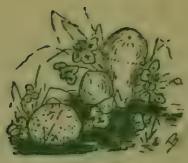

NATURE STUDY.

A monthly magazine, published under the auspices of the Manchester Institute of Arts and Sciences. EDITOR: Edward J. Burnham. ASSOCIATE EDITORS: Frederick W. Batchelder, William H. Huse, Susy C. Fogg, Theodora Richardson.

Devoted to the encouragement of the study of Nature in her varied aspects—of the Rocks, the Birds, the Flowers, and all the multitude of living things that crawl or swim, or walk or fly.

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NATURE STUDY PRESS, Manchester, N. H.

Entered as Second-Class matter at the Post Office at Manchester, N. H.

"Gravel banks composed of till are common everywhere."

NATURE STUDY.

PUBLISHED UNDER THE AUSPICES OF THE

Manchester Institute of Arts and Sciences.

VOL. III. March, 1903. NO. 10.

Our Glacial Inheritance.

BY WILLIAM H. HUSE.

Our hills and valleys, our lakes and rivers, are nearly all, directly or indirectly, the product of the scouring and scraping that was done by the ice sheet millenniums ago. There are some topics in geography that must be studied from the textbooks alone or, at best, shown by pictures, but in the northern states the work of the glacial period can be studied anywhere. At the summit of Mt. Washington bowlders have been found, and the ledges on the New England coast are polished and grooved, looking as they did when their ice covering melted and disappeared.

Gravel banks composed of till are common everywhere. In the one shown in the frontispiece the line of demarcation between the unstratified and stratified deposits is easily seen. The lower portion is composed of till, the hard gravel so valuable for roads. In fact, the bank is being rapidly carted away for that purpose. The deposit is so solid that the marks of the pick-axes made several days before the picture was taken were perfectly clear and distinct. The stratified gravel above shows no such

marks. The clay was washed further down the valley while the sand and water-worn rocks were left here.

In the till are found bowlders of all sizes and kinds. They are all strangers, brought from ledges farther north. Bowlders of porphyritic gneiss that is not found near Manchester in ledges are here abundant. Fragments of mica schist that have long been safe from weathering are now crumbling in the air. One large bowlder of quartz was found that was crossed by several veins of a jaspery nature. In another place was found a large specimen of conglomerate considerably metamorphosed. None of these are found *in situ* near their present location. Numerous scratched or polished specimens have been found and carried off to illustrate the glacial period. This gravel bank, located on Cilley street in Manchester, may be of little interest to those living at a distance but it will serve as a type of similar deposits found wherever the ice-sheet went. They are of inestimable value to geography classes.

The larger bowlders found upon the surface of the ground everywhere in the north are always interesting. They bring to our doors the ledges of other localities. While the large specimens are of no more real interest to the geologist than the smallest, they are more striking to the observer and especially to children. Prof. Hitchcock, in his geology of New Hampshire, describes many. Perhaps the largest that has been found yet in this state is the Churchill Rock of Nottingham, 62 feet long, 40 feet wide and 40 feet high. It contains 75,000 cubic feet and weighs about 6000 tons.

The two bowlders figured in this number of NATURE STUDY are found near Manchester, and are probably the largest in this vicinity. In the southern part of Dunbarton is a well rounded bowlder of porphyritic gneiss, 35 feet long, 31 feet wide and 20 feet high. This stone rests in a swamp apart from all other rocks. The height given was

measured from the surface of the ground. How far below the bottom of the bowlder is is not known. The weight must be nearly 2000 tons. A little larger than this bowlder, and probably the largest in the immediate vicinity of Manchester is one situated near the west bank of Manter brook on the line between Manchester and Londonderry. This is 38 feet long, 35 feet wide and 19 feet high above the surface of the ground. The weight must be in the vicinity of 2500 tons. It is composed of the ordinary gneiss so common throughout New Hampshire. This bowlder was so prominent a feature of the landscape in early days that the deeds of land in its vicinity in colonial times usually located one bound as such a distance in such a direction from "The Great Rock"

A Useful Family. V.

BY FREDERICK W. BATCHELDER.

As a rule, the most valuable grasses require a rich soil. It does not follow that all grasses of poor soils are useless to mankind. Certain grasses which are worthless for any of the purposes I have hitherto noted have a peculiar value, due to the character of their underground stems and their rootstalks and roots. These grasses are the "sand-binders." Their value has long been recognized, and at the present day they are objects of renewed interest for economic reasons.

There are in various parts of the world tracts of land which consist wholly of sand. In our own country, while we have no great desert like the African Sahara, old atlases of the United States to the contrary notwithstanding, we have a great many small deserts. Years ago, one of these existed in the town of Hudson, near the Nashua bridge. The loose sand drifted in such quantities as to block the

road and to seriously damage neighboring fields. The towns-people were at their wit's end to know what to do to abate the nuisance. Various expedients, such as the planting of willows and the building of fences, were tried, but without success. At length some wise person suggested the remedy which had proved successful in staying the drifting sands on Cape Cod. A sufficient number of cuttings of the sea sand-reed (*Ammophila arenaria*) were procured and planted over the tract, and in a few seasons the desired end was accomplished, the grass throve and covered the tract, the drifting sands were stayed and the Hudson desert became only a memory.

What was here done on a small scale has been done on a large scale along our seacoast. There are large tracts on the shores of the great lakes and in the arid southwestern states and along the Columbia river in Washington and Oregon where similar treatment is imperatively required if the safety of live stock or even of man is to be assured. Sand storms like those of the Arabian desert, and even whirlwinds of sand resembling waterspouts, are a constant menace to life and property in the immediate vicinity. Moreover, the sand is perpetually traveling in the direction of the prevailing winds, so that the desert is continually enlarging at the expense of the adjoining fertile lands. There is absolutely nothing which can be done to stay this destruction except to plant the sand-binding grasses. This the United States Government has already begun to do in certain localities. The vastness of the afflicted tracts will make the work of reclamation a long, arduous and expensive one. The hopeful thing about the ontlook is that when a tract has been once reclaimed by the planting of grasses and subsequently by the planting of trees, it will not return to its former condition, but will continue to improve. The wood grown upon it may even in the course of time become a source of revenue.

The kinds of grass by means of which the process of reclamation must be initiated are the sea sand-reed, mentioned above, which is the best of all, and also sea lyme-grass (*Elymus arenarius*), bitter panic grass (*Panicum amarum*), sea oats (*Uniola paniculata*), and others of local but less general value. According to Scribner, the agrostologist, the sea sand-reed and the sea lyme-grass, "when combined, seem admirably adapted for the purpose of forming a barrier to the encroachments of the sea; the sand that Beach-grass arrests and collects about itself the Lyme-grass secures and holds fast." Concerning the Beach-grass (sea sand-reed) the same authority makes the following somewhat amazing statement: "The sand collects around the clumps of grass, and as it accumulates the grass grows up and overtops it, and will so continue to grow, no matter how high the sand hill may rise. A plant will, by gradual upgrowth, finally form stems and roots sanded in to the depth of fully 100 ft.!"

[F. Lamson-Scribner, Bulletin No. 3, U. S. Dept. Agr., Division of Agrostology, Useful and Ornamental Grasses. 1896.]

To all the other useful properties of the grass family, then, may be added these, that it can stay the onset of the sea, and that it can make the desert blossom as the rose—statements not so hyperbolical as they may sound. It is undoubtedly a fact that the rich and prosperous country of Holland could not have attained its commercial and financial eminence but for the grasses that bound the sands that composed the dikes that fended the ocean off her cultivated fields. To compare small things with great, Provincetown, on Cape Cod, would have been buried in sand or washed away, but for the same humble barrier-forming plants. Every year in the month of April, the inhabitants were formerly obliged by law to turn out and plant "Marram," as the grass was called, until both sea and sand were conquered and the safety of the town assured.

As a conclusion to this series of articles on the most useful family of plants, I will give a few facts relating to those grasses known as cereals, of which the value lies principally in the seeds. In the United States these are, in the order of their total annual value, corn, wheat, oats, barley and rye, to which must be added rice and the recently introduced Kafir corn, a species of sorghum, valuable for its grain. In the census reports buckwheat is classed with the cereals; as it is not a grass, but a member of the knotweed family, (Polygonaceæ), it is excluded from our present consideration. In American reports, by the way, corn means only Indian corn or maize.

Rye is much less used in America than in Europe, being less esteemed for making bread. Pennsylvania, New York and Wisconsin raise nearly half of the total product. Whether its employment in the manufacture of whisky and malt liquors would come under the head of proper use, is a question with regard to which there might be divergence of opinion. The same with respect to barley, which is largely employed in the process of brewing ales and beers. Barley is the most important cereal of the far north, growing in Norway as far up as latitude 70 deg. California leads in the production of barley in the United States. The product of oats in this country is greater in bulk of grain but less in value than that of wheat. The grain is principally cultivated as food for horses, though it is constantly gaining in popularity as a breakfast food. Being deficient in gluten, it does not make good bread. It is the most nutritious of all the grains, containing more nitrogenous matter than soft wheats, and more fats than any of the other cereals. In the South and in California oat hay is extensively used as fodder. Wheat, in itself the most valuable of the cereals, yields the next to the largest crop in this country. Its paramount value is too well known to require special note here. The largest cereal crop, both

in bulk and in money value, is that of corn, the uses of which are known to everyone. In some parts of the west, away from the market centers, where corn is abundant and wood scarce, it is used as fuel and answers the purpose admirably. There is literally "corn to burn."

From the Census Report of 1900 I have taken the following estimate of the quantity and value of cereal crops for the year 1899:

Corn,	2666	million	bushels,	valued at	828	million	dollars.
Wheat,	628	"	"	"	"	369	"	"
Oats,	943	"	"	"	"	217	"	"
Barley,	120	"	"	"	"	41	"	"
Rye,	25	"	"	"	"	12	"	"
Rice,	4	"	"	"	"	7	"	"
Kafir Corn,	5	"	"	"	"	1	"	"
Total,	4391	million	bushels,			1475	million	dollars.

Guatemala's Bird of Freedom.

BY EDWARD J. BURNHAM.

In these days of stamp-collecting, most young people have seen postage stamps from Guatemala, and are more or less familiar with the figure of the beautiful bird which that little Central American republic long ago selected as its national emblem. It is one of the trogons, a family of birds found only in the tropics, and more abundant in Central and South America than anywhere else in the world.

Guatemala's bird of freedom is the most beautiful of all the trogons, but is rarely seen away from its home in the dense forests on the high ridge that forms the backbone, as it were, of Central America. There are two reasons for this, one being that it soon dies in captivity, and the other that there are severe penalties of fine and long imprisonment for any one who kills, captures or in any way disturbs it. It is because it cannot endure captivity that it was

chosen as an emblem of liberty by a free people; and it is jealously protected, partly because of its wondrous beauty, and partly because it was for many, many centuries, perhaps for thousands of years, looked upon as sacred, and the impression of the old idea has not yet wholly disappeared.

The quezal is a small bird, about the size of a pigeon, but two of its beautiful tail feathers are often fully three feet long, and its head is surmounted by a crest in the form of an ancient helmet. The feathers of the back do not lie closely together, as in most other birds, but fall over the shoulders and sides in resplendent waves. The feathers of the head and back, and the two long tail feathers, are a brilliant golden green; the remaining tail feathers are black and white, and the breast is a bright scarlet.

It is little wonder that the gentle Mayans, whose inscriptions on their long-since ruined temples still remain undeciphered, and who were conquered by the fiercer Aztecs, associated this bird with their beneficent sun god, or that the Aztecs themselves, in a later time, reserved it exclusively for their emperors. The wonderful head-dress worn by Montezuma when Cortez first met him, was made of the long tail feathers of the quezal, each supported erect by a thin strip of rare wood, and the whole bound together with fillets of gold.

The mythology, as well as the history of the Mayans is almost wholly lost, for no one has yet been wise enough to read the inscriptions that have been found in the ruins of the ancient cities of Yucatan and other portions of Central America. A few dim traditions, however, have come down to our time, and one of the most beautiful of these is the legend of the sun god and his bird companion, the brightly gleaming quezal. It has been told again and again, as all good stories of the olden time have been, and

will doubtless continue to be repeated for many generations to come.

Once upon a time, so runs the story, there came a great man to the land of the Maya. His name was Quezalcoatl, and he was noble to behold and had a great heart. He was born far away in the Land of the Sunrise, Tlapallan, which lies across the seas and never is darkened.

His face was fair, and he had shining eyes. A full beard flowed to his breast, and his look was the look of calmness and peace.

Long he waited in the sunland of Tlapallan, till the right time. Then he crossed the sea. His canoe was a mighty seashell, and it was blown over the deep as foam is blown along from ridge to ridge of the rollers. So he landed on Mexico's shore.

Clothed in pure white, he wandered through the land. He asked no sacrifice of beast or man for his altar. He accepted offerings only of flowers and fruits. Gentleness, friendship and love were all that he preached.

Where he trod, the earth rejoiced. Green lay his path behind him. Barren lands became rich, rich lands became prodigal. Cotton sprang up everywhere. Maize grew to such dimensions that a man could carry only one ear at a time. Fruit filled the land with its fragrance.

Wherever Quezalcoatl appeared, the air became filled with the perfume of flowers, and birds of amazing beauty flew through it.

So sweetly did they sing that men's souls melted when they heard. Warriors laid their weapons aside and kneeled to listen. Enemies forgave each other. War and hatred disappeared from the world and there were only love and the song of the birds.

Most glorious of the birds was this one. It shone scarlet, and that was its dear breast. It shone green, and that

was its soft body. It shone golden, and that was from its tiny helmet and long, long tail.

Wherever this bird appeared, men knew that the god Quezalcoatl was nigh. So they came to know the shining bird as the bird of their sun god, and they called it quezal.

Evidently we have in this myth an instance of the philosophy of a primitive people explaining the presence in their forests of a bird of rare beauty. But manifestly no such tale can stop at the golden age, if it is to have the appearance of truth. The gentle Maya, who worshipped the beautiful quezal, knew that in their own time the earth did not bring forth without labor, that the maize was frequently small, and sometimes failed altogether; the fierce Aztecs already pressed sore upon them, and there was cruel strife in the world.

Plainly, these obvious facts in Mayan experience, in all human experience, demanded explanation, and so the myth continued:

There came a day when Tezcatlipoca, the god of Darkness, gave Quezalcoatl a magic potion that made him old and weak, and filled his heart with longing for his home in Tlapallan. And he went to the shore of the sea, and he stepped into his great shell canoe and went out into the sea never to return.

What followed is still told by the old men among the Indians, who rehearse to their young men the tales of other days.

When Quezalcoatl's shining boat disappeared beyond the horizon, the maize became small, and the cotton died, and the hearts of men awoke again to war.

In the battles that came the temples of Quezalcoatl were thrown down. His priests fled from place to place, till at last only a few still worshipped him and performed his rites in the deepest of the mysterious mountains.

Bowlder of Porphyritic Gneiss, Dunbarton, N. H.

"The Great Rock."

In time these faithful ones died, too, and the Mayan nation and the Mayan faith passed away. The Aztecs came, with their new ways and new religion, and grew and built a nation.

The ruins of the Mayan cities and temples have been to some extent explored. Many inscriptions have been found, some evidently of considerable length. Casts of these have been placed in many of the great museums, but no one is able to read them. It is as if the printed story of a people were spread out before the blind.

Of the beautiful trogon of the Cordilleras, a recent writer has said: "The Mayan nation had been so long forgotten that no man could tell aught of them except dim stories half remembered. The Aztec nation became very, very old, and then it, in turn, passed before the white man from Spain. Through all the ages one creature has remained unchanged and beautiful and ever free. It is the quezal. And it still flies in its ancient splendor through the lost land of long dead nations in Central America."

Disappearing Birds.

Young birds have to be taught a great many things, but there are some feats which they know without instruction. In a large open air cage in the New York Zoological Park is a covey of six California partridges, about one-third grown, and their little bantam stepmother. She dozes at one end of the range or walks slowly about, pecking among the blades of grass. The small sextet keep close together, and if we watch them for several minutes, we will see some of the things which must have come to them as their feathers and little bills came—from the egg. Unlike the hen, they are suspicious of your every movement, but in a short time they forget that you are not a lifeless tree trunk or other harmless object near their cage. They select a sunny spot, always on the dead leaves, never on the green grass, and here, after much cuddling and pushing, but never a peep, they squat, usually in an irregular circle with heads outward. Unless there are dead leaves or some

similarly colored surface in their cage, they never settle down contentedly for a sun bath.

We watch them nestle close to the ground and close their eyes; then some movement on the part of the hen may attract our attention for a moment, and, on looking back again, we are amazed to find the little birds have disappeared. It is a fact that if we lose sight of them even for a short time, the eye at first refuses to distinguish them from the dried leaves. Their little backs are dull, dark brown in color, broken by irregular fine white lines, very much like the mold lines on fallen leaves, while the lighter sides of the head, instead of being at all conspicuous, are exactly like the lighter shades of some old leaves, the imitation being more perfect from the fact of the coloring being thus broken up. Even the little brush of upraised feathers in their heads—hints of the beautiful recurved helmets of the old birds—appear like small, frayed out pieces of grass or leaf.

If we look toward them with half-closed eyes not a trace of the birds is visible. All appear sound asleep, and the little heads sag drowsily to one side, but at the slightest noise each black bead of an eye is wide open, and six scurrying pairs of legs, or rounded, whirring wings, carry their owners to the further side of the cage, as if an unfelt wind had suddenly caught up some of the dead leaves before us and tossed them along the ground. It is all a beautiful piece of magic, which never becomes less wonderful, no matter how many times we witness it.—*New York Times.*

A Punctual Bird.

What tempts the little humming bird that we see in our gardens to travel every spring from near the equator to as far north as the circle, leaving behind him, as he does, for a season, many tropical delights? He is the only one of many humming birds that pluckily leaves the land of gayly colored birds to go into voluntary exile in the north, east of the Mississippi. How it stirs the imagination to picture the solitary, tiny migrant, a mere atom of bird life, moving above the range of human sight through the vast dome of the sky! Borne swiftly onward by rapidly vibrating little wings, he covers the thousands of miles between his winter home and his summer one by easy stages and arrives at his chosen destination, weather permitting, at approximately the same date year after year.—*Country Life in America.*

The Growing Interest in Nature Study.

BY EDWARD J. BURNHAM.

There was some reason, a few years ago, to fear that nature study, as introduced in the schools, might prove to be a mere "fad," to attain a rapid and unhealthy growth, have its brief day, and fall into disrepute as a factor in education. There were those, however, who maintained from the first that when allowance had been made for ill-directed enthusiasm and the tendency to over-do in any line of effort that has suddenly become popular, there was still enough of genuine merit and value in the study to enable it to retain a recognized place in school work.

Time has verified the prediction, and nature study, with much less reaction than was to be expected, is now firmly established as the best possible means of quickening the faculty of observation and as a valuable aid in the work of developing the reasoning powers.

But nature study has also within itself the power of adding to the enjoyment of existence, of increasing the sum of human happiness, and could not, therefore, long be restricted to the schools. There is need of it in the world as affording at least an occasional relief from care, a solace in grief, and a wholesome reaction from the strain and stress of active life. It was certain, sooner or later, to find recognition among active men and women of all sorts and conditions, less for the discipline than for the wholesome relaxation it affords.

This recognition has come more rapidly than can be realized without unusual means of securing information. NATURE STUDY has the service of the United States Press Clipping Bureau of Chicago, and is thus able to follow, from week to week, what is going forward in its special lines throughout the country.

The activity in nature study outside the schools, as indicated by local items in the newspaper press, is a matter of surprise. A few clippings taken at random, must stand as examples of the whole.

In New England and in the Middle Atlantic States there is scarcely a village in which work of some sort along nature study lines is not undertaken and regularly sustained. There are Audubon societies, natural science clubs, botanical classes and similiar organizations almost without number, and the reports of their meetings appear in the local press as regular and important contributions to the news of the day.

Farther west the work is taken up with equal ardor and undoubtedly with equal intelligence, although the hapless reporter sometimes finds himself, as it were, in deep water. Thus we are gravely informed by the local paper at Carthage, Missouri, that the class in botany is engaged in the study of a "zerophytic" plant which had been sent from Arizona, and of a "sun-due." Readers of NATURE STUDY who have enjoyed Mr. Batchelder's papers on zoophytes, including the sun dew, will have no difficulty in perceiving the reporter's intent. The same class was also fortunate in being able to study the pitcher plant, "so called on account of the way it holds water, and thus many insects are drowned, from which source the plant gets its nitrogen supply." We are told that the specimens were obtained from the botanical garden in Washington; a statement which will remind New England readers that a plant or animal which is common in one section of the country may be a rare wonder in another.

At Cedar Rapids, Iowa, Professor McBride of the University of Iowa has delivered, during the winter, a series of instructive lectures on "The Plant Responsive," which, by the way, have attracted attention far beyond the limits of the State.

The Wisconsin Natural History Society, located at Milwaukee, has provided a large number of free popular lectures during the fall and winter, and the museum of the society has been rapidly enlarged.

The Floral Association at Richmond, Indiana, held a flower show about the middle of January, which was a grand success, and the next step will be exhibitions of wild flowers in the spring and summer months.

Battle Creek, Michigan, has an active and prosperous organization known as the Nature Club, devoted to the study of natural history in all its branches during the winter, and to outings and field work in the summer. The Detroit *Free Press* informs us that the club "meets every Thursday night and has fifty members, a number of professional and business men belonging. The members are desirous that nature lovers in other parts of the State organize similar clubs and correspond with the President of Battle Creek Club, Charles E. Barnes."

The following news item from the Milwaukee *Evening Wisconsin* is suggestive of great possibilities: "Seventy-two tulips, given by one of the city florists, furnished material for an interesting lesson in nature study at the meeting conducted by Miss M. L. Russell, assistant extension secretary of the Y. W. C. A., at Patton's factory Wednesday noon in the large lunch room used by the employes. Seventy young women learned the names of the flower parts and were so interested in the work that it will be continued. Seeds will be planted in boxes and the growth studied."

While these are but a few cases selected from many, they serve to indicate a marked tendency of the time—a growing interest in the objects of nature around us, in the vast sea of life of which we ourselves are a part.

Geography.

Geography is the one subject in the elementary schools that easily co-ordinates with nature study, for it is nature study, or should be. The lack of interest that is too often seen among pupils in this subject is due to the fact that it is not made a study of nature, but of a textbook. The number of teachers that are subcribers to NATURE STUDY is so large that this subject will be a regular feature of the magazine in the future, and contributions are invited from teachers or any that are interested. In this way the publication will be more valuable to its readers and carry a fuller message to those who love nature.

A Meadow Lark in Winter.

Editor of Nature Study :

On February first of this year Oak Hill in Manchester was almost entirely covered with snow. Here and there on the southern slopes it had blown off, or melted away, leaving the bare earth exposed. On the date mentioned I saw a Meadow Lark (Sturnella magna) fly up from this feeding ground. His flight was a short one, and he alighted on the ground again. I approached nearer, when once more he flew : this time into a tree. A third time I saw him fly, and this time he went beyond human ability to follow. Of course he had not shown me his breast, and his small size puzzled me. A second trip made on the afternoon of that same day to that same spot revealed him without a doubt to be a Meadow Lark. The little fellow had wintered here. That his fare had been meagre his thin body and forlorn appearance testified. Again on the fourteenth instant he was seen in the same place, alone as before. This time he took me into his confidence and

showed me his yellow breast with its black crescent. It seems to me the bird must have been left behind by the fall migrants, possibly to nurse a wound. Or he may have lost his way when on his southern trip. Whatever was the cause of his appearance here in an uncommonly snowy winter, it certainly was unusual enough to call forth this public notice of his presence. My companion, a far more accurate observer than I, can corroborate this statement—lest any doubt the word of

THE PIN-FEATHER ORNITHOLOGIST.

Manchester, N. H., February 28, 1903.

Drinking Water in a Cactus.

Many a traveler in desert lands, when in danger of dying from thirst, has been saved by the plant known as the water or fishhook cactus.

During the moist season it stores up a large quantity of water for the subsequent dry one, when all the ground is parched with heat and only channels filled with stones mark the course of former rivulets.

So well has this cactus provided for the safety of its precious liquid that it is no easy task to obtain it. The exterior skin is more impenetrable than the toughest leather and besides it is protected with long wiry spines curved into hooks at the end, yet so strong and springy that if a large rock be thrown against them they would remain uninjured.

If the spines be burned off, one may, by long and tedious effort, cut through the rind with a stout knife; otherwise nothing but an axe will enable him to get at the interior of this well-armored plant. When the top is removed and a hollow made by scooping out some of the soft inner part, it immediately fills with water—cool and refreshing though a blistering sun may have been beating upon the tough skin above it all day. The water when first obtained has a whitish or smoky tint, but when settled is as clear as crystal. —*Omaha (Neb.) Enterprise.*

Nature Study Lessons. X.

BY EDWARD J. BURNHAM.

There is a fascination about a brook at every season of the year, but the spell is most potent in springtime. The angler feels it, and examines his tackle long before the ice has gone from the streams; the small boy feels it, and is conscious of vague yearnings within him. It is little wonder that the earliest of the Greek philosophers, groping about, trying to find a reason for things, came to feel that water was the great first cause, the origin and source of matter and of life. A rude and crude philosophy; and yet the boy feels some faint impulse from it today, as he peers questioningly into the dark pool by the overhanging bank, and the biologist feels it as he studies the beginnings of life in the tiny forms that are ceaselessly multiplying in pond and stream and sea.

Nature study walks in spring and summer ought sometimes to lead along a brook, and there should be dredging and investigation. If somewhat of the fascination of mystery is lost, as the vague belief in huge fantastic shapes is dispelled, there will come the more satisfactory consciousness of knowledge gained; and the real forms, although so much smaller than fancy pictured them, are sufficiently fantastic to satisfy the liveliest imagination.

There ought to be nothing formidable about the word aquarium. It is merely a convenient term used to express the idea of a dish, a pan, a pail or a tub used to hold water and the many kinds of creatures and plants that live in it. Almost any sort of a receptacle that will hold water will answer for an aquarium, and in the warm weather of spring and summer it can be set out of doors, in a shed—almost anywhere. If, some rainy day, it is permitted to be placed on the kitchen table, the children will forget that

the sky is overcast, or, if remembering, will cease to care. The dredging outfit may be very simple. A tin pail that once held lard or cottolene, or a glass fruit jar, will serve to hold the "catch," while almost anything that will scoop or dip will do the dredging—an old dipper with small holes punched in the bottom, a skimmer, an old corn-popper, a bag of stout netting attached to some sort of handle—something of little value may be found about any home that will serve the purpose admirably.

Now all is ready for the expedition. In early spring the brook will be swollen, but there are always accessible points by which it may be approached, and if, by some misstep, there is a wetting, it scarcely need mar the enjoyment of the hour. It is very doubtful if any harm will follow. In many years of experience and observation, I have never been able positively to trace a cold to a wetting of the feet, or to outdoor exposure in any form.

So once at the brook, begin to dredge, and do not be over mindful of mishaps. Somewhere along the shore, there will be an indentation, filled with still water, and with dead leaves and mud at the bottom. This will prove rich dredging ground. Every sweep of the scoop will bring up large numbers of may-fly nymphs, of two or three kinds, some large, some small, and all rapidly waving their rows of gills as they stir the water for a breath of air. These should all be taken home, for, besides being interesting objects of study, they will be needed as food for other creatures that may be placed in the aquarium.

From the same quiet, pool-like places will come the queer-looking dragon-fly nymphs, without which no aquarium would be considered complete nowadays; and there will be several kinds of caddice-fly larvæ—some in cases built up of bits of sticks laid crosswise, in cob-house fashion, others in houses of sticks placed lengthwise, and still others in houses of leaves loosely fastened together. In

places where the brook runs somewhat swiftly over a sandy or gravelly bottom, will be found caddice-worms that make their houses of tiny stones, often with little snails built into the walls alive.

On the surface of the eddies and pools will be found the water-striders, actually walking and running on the water, and patches of whirligig beetles, with eyes above and below, and whirling round and round like mad to keep out of trouble and catch something to eat. Now and then a big water beetle or a water bug will be caught, the one having jaws like all beetles, the other a sharp beak like all bugs. These and many other queer creatures should be placed in the aquarium and watched. It is better than a story about things to see things one's self. As a bit of encouragement, however, the next nature study lesson will tell of some things that a real boy and girl have seen in an aquarium.

The Grave-Digging Beetle.

The grave-digger beetle formed the subject of an interesting experiment that was conducted recently by an ingenious student at the university. The young man had secured from some place or other four hale beetles of the grave-digger variety. He put them in a box filled with earth, and then he threw in to them a small, dead sparrow. Instantly the beetles began to dig beside the bird. They worked like beavers for two hours, when one of their number, for some reason or other, ceased. But the rest kept on for three hours more, when all dropped out but one. He indomitably continued, and in a little while he had finished a hole just big enough for the sparrow and six inches deep. Then, with a herculean effort, he shoved the bird into the grave, and, with his companions, piled on the soil again. For several weeks the experiment of the student went on, and during it the beetles buried five frogs, two grasshoppers, four birds and a mole. These grave-diggers lay their eggs in dead flesh, and then bury the flesh. Their larvæ, hatching out under ground, feed on the carrion provided by their thoughtful parents till they are ready, as full-fledged beetles, to come up out of the earth. Then they, too, take up the grave-digging trade.—*Philadelphia Record.*

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Nature Study...

Vol. III APRIL No. 11

MANCHESTER, N. H.
NATURE STUDY PRESS
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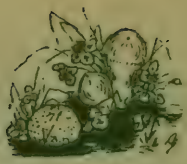

NATURE STUDY.

A monthly magazine, published under the auspices of the Manchester Institute of Arts and Sciences. EDITOR: Edward J. Burnham. ASSOCIATE EDITORS: Frederick W. Batchelder, William H. Huse, Susy C. Fogg, Theodora Richardson.

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NATURE STUDY PRESS, Manchester, N. H.

Entered as Second-Class matter at the Post Office at Manchester, N. H.

WORK OF TERMITES IN MANCHESTER, N. H.

PHOTOGRAPHED BY W. H. HUSE.

NATURE STUDY.

PUBLISHED UNDER THE AUSPICES OF THE

Manchester Institute of Arts and Sciences.

VOL. III. April, 1903. No. 11.

Damage by White Ants.

BY EDWARD J. BURNHAM.

The frontispiece this month illustrates the damage done by termites, or "white ants," in Manchester, N. H., in the winter and spring of 1903. A large vault used by a business house, was found to be infested by these insects. The illustration, reproduced from a photograph, shows how the canvas covers of two large desk books had been eaten. The oblong object in front of the books is a package of papers which had been pierced through and through. Several books and packages had been similarly injured.

The vault, located in a basement and designed to be fireproof, is built of brick, the walls, including a narrow dead-air space, are sixteen inches thick. The walls are surmounted with railroad iron, and entrance to the vault is by two close-fitting iron doors, one within the other, there being the thickness of the wall between them. It was intended that this storage vault should be air-tight, and having been constructed only five years ago, it is next to impossi-

ble that an insect of the size of the termite could find ingress.

When the vault was built, it was sheathed with white pine boards from sapling trees. Some of these boards are stained in a way which indicates that the logs from which they were sawed had lain exposed throughout a summer, probably in a mill yard. When discovered, the termites were numerous in these sap-stained boards, from which they had found their way to the books and papers on the shelves. The brick walls of the vault appeared to have no cracks through which the insects might have entered, and it is probable that they, or a few ancestors, were in the logs before they were sawed into boards. An obvious objection to this supposition, however, is the slow rate of increase for at least the first four years ; but this might, perhaps, be met by the assumption that for a time reproduction had been by supplementary queens, in place of the much more prolific true queen. If, in course of time, a true queen developed, there would then be such a rapid increase as, in this case, first attracted attention last March. The vault is situated in a basement from which a business block is heated, and the steady warmth throughout the winter undoubtedly stimulated the termites to a degree of activity unusual with them in northern latitudes.

The special interest in the damage done by these insects in Manchester is due to the fact that this locality must be very near the northern limit of the range of this species (*Termes flavipes*). Small colonies are somewhat numerous about Manchester, under stones and rotting logs in waste places, but I have not been able to learn of them farther north than Hooksett, the next town above Manchester in the Merrimack valley. I am not aware that any injury by them has heretofore been reported in New England.

Dr. L. O. Howard, Chief of the Division of Entomology

in the United States Department of Agriculture, states that "From Baltimore southward, and perhaps a little farther north, this insect becomes a serious pest in houses, particularly in old houses which are rather damp." After describing the tunnels, running with the grain, in old beams and floor joists, he goes on to say: "Quite recently a handsome private residence in Baltimore was found to have its timbers on the first floor reduced almost to shells by the workers of this insect. Further south, not only the buildings, but even the furniture, is destroyed by them in the same way. They seem especially fond of paper, and Forbes has recorded the fact that a collection of books and papers of the state of Illinois was completely ruined by them. A school library in South Carolina, which had been left closed for the summer, was found, on being opened in the autumn, to be completely eaten out and rendered valueless. The work of these insects was brought home strongly to the writer on one occasion when a lot of records and documents stored in a vault in the Department of Agriculture was found to be mined and ruined by them; and again, the floor of one of the largest sections of the United States National Museum was annually undermined and weakened until it was torn up and replaced with cement."

The use of furnaces and steam boilers for heating purposes has wrought a great change in uniformity of temperature in residences and business blocks in New England, artificially producing, in basements at least, something like tropical conditions, and it may be that greater care and watchfulness will become necessary in consequence. The white ant, in New England, has heretofore been a well-behaved and entirely harmless insect, but although its presence in the basement in question was almost certainly involuntary, it was able to adapt itself successfully to its new environment.

The Transcription of Bird Songs.

BY FREDERICK W. BATCHELDER.

The attempt to describe the song of a bird is one of the most baffling experiences that comes to the student of bird life. Literature teems with descriptive passages, frantic, rhapsodical, nonsensical for the most part; occasionally sincere and suggestive, if not accurate; very rarely just and exact. As in other matters pertaining to the domain of musical and individual taste, training, quickness of perception, keenness of sympathy, all these things influence the mind of the writer and give color and shape to his thought. Modern professed authors of works on nature study would of course be expected to come nearer to achieving a success in this line, and it is doubtless true that they have done so. Yet it must be admitted that their attempts are for the most part very unsatisfactory. For my own part I am glad of it! I am glad there is to be something left to us which is not likely to submit to quantitative and qualitative analysis, which cannot be weighed nor measured nor made into a dried or stuffed specimen. Without some such vivifying element of uncertainty, literature would be in danger of strangulation at the hands of analysis. There is more need than ever of romance in this matter-of-fact century, this era of machinery-worship; so let us be thankful that there will always be the romance of the birds, with the marvels of flight and of plumage and of love-making and of song, a new volume every year, ever fresh and soul-inspiring, so long as the world shall last.

It is not, however, the description but the transcription of bird songs which I propose to treat of at present. At the outset I am compelled to admit that I approach this subject with less confidence than when I began to study it several years since. It is easy enough to rhapsodize about

bird songs and to write poetry about them and to tell the world how they make you feel. It is quite another matter to transcribe them, to represent them in an intelligible notation. My experience has been something like this. I had always been dissatisfied with both the descriptions and transcriptions of bird songs as they appeared from time to time in bird books and in periodicals, and I saw no reason at first why I might not improve upon them. So I plunged boldly in. At first I endeavored merely to recollect the song and make my notes after returning from the field. I soon found this method would not work, for recollection proved to be exceedingly difficult. The reason for this I did not at the time apprehend. Next I made it a practice to take down each phrase on the spot and at the moment. This promised better results, and, in fact, yielded better results in that I could begin to see some relation between my notes as written and the song as delivered. Gradually it dawned upon me what was the chief cause of the difficulty. It was simply this—the songs of birds very rarely, except by accident, fit our musical notation. Our scales, especially the major scale, are very artificial and very incomplete. In our notation the tone space between any given tone and its octave is arbitrarily divided into twelve equal or nearly equal parts. In the major scale one set of seven tones, and in the minor scale another set, are selected as scale or diatonic notes. The minor scale is, I think, a better medium for the expression of the music of nature than the major scale, the latter having been smoothed down and tempered to meet the demands of civilization. It is certain that the minor scale is the stronger. Now this difference in the two scales is manifested also in the harmonies associated with and produced by them. Each tone of the major and of the minor scales is the foundation of a chord made up of a succession of major and minor thirds, and each of these chords has a char-

acter of its own and a peculiar relation to the other chords. It would then be perfectly natural that the scale which produces chords of the greatest variety and individuality should be the nearest to nature. This is true of the minor scale. The seven tones of the major scale produce three kinds of three-voiced chords (triads), three of them major, three minor and one diminished. The seven tones of the minor scale produce four kinds of triads, two minor, two major, two diminished and one augmented. The seventh-chords founded on the fifth tone (dominant) of the scale in both major and minor are identical, but the ninth-chords founded on the same tone are different, the dominant ninth-chord in the minor key being the richest and fullest of all chords and being called the fundamental chord of nature. In the key of C minor this chord would have the base G with its major third B, its fifth D, its minor seventh F and its minor ninth, A flat. So much for the comparative value of the two scales and the harmonies belonging to them.

The music of birds is baffling to the transcriber because the singers do not conform to the requirements of our notation. They produce not merely twelve tones of different pitch between a given note and its octave, but any number; mathematically speaking, an infinite number. If a violin player starts a tone, say, on the open A string and slides his finger up the string without interrupting the bowing until he has sounded the octave above he has practically produced an infinite number of tones of different pitch within the octave. Our chromatic scale from A to A inclusive may be represented by thirteen beads on a string, separate and equidistant. On the violin the scale described above, the sliding scale, could only be represented by the string which holds the beads;- i. e., by a continuous line. The notes of bird songs may alight at *any point* of this continuous line, not merely on one of the

thirteen tones we employ. So it comes to pass that many or most bird songs cannot adequately be expressed in our notation. The best the transcriber can do is to bring them as near to it as possible.

An additional difficulty attends the transcription of the songs of the true thrushes, our finest singers; indeed, I may say the finest singers in the world. Owing partly to the peculiar resonance of tone produced by them and partly to the fact that the songs are usually heard in wooded localities where echoes abound, the effect is as much due to harmony as to melody. This is an important consideration and its understanding will help to explain much of the mystery associated with these songs. It is not likely that any bird can sound two or more tones at the same instant. Yet there is undeniably an effect produced as if they could and did. How can this be explained? Take a simple illustration. If you strike the notes of a chord one by one on the pianoforte, keeping the fingers down or using the open pedal, the vibration of all the strings struck will presently be heard as a chord, lingering as such for a time proportionate to the sustaining power of the instrument. A similar process goes on in the woods when a Veery sings. His succession of arpeggio-like passages, while in fact only a succession of single tones in rapid movement, is caught up by the echoing trees and banks and rocks and hills in such a way that the earlier notes of a phrase are still vibrating in the air when the later ones are produced, and there ensues an overlapping and intertwining of tones of various pitch and in various harmonies. The song of the same bird in the open field and in the forest would scarcely be recognized as identical.

The rhythmical element in bird songs may be represented without difficulty, and the rhythm is in many cases so characteristic as to be of great value in the identification of the singer. For example; the songs of the robin and

the rose-breasted grosbeak are not easily distinguished by the young student of bird life. The grosbeak is less known than the robin and everyone should as soon as possible learn to recognize the two both by plumage and song. Besides being richer in quality than that of the robin the grosbeak's song is also quite different in rhythm, being in double time while that of the robin is in triple time. A little careful observation this coming season will demonstrate this fact to any one who cares to follow the matter up.

Notwithstanding the difficulties in the way of properly transcribing the songs of birds, I, for one, propose to keep trying, and I hope others will do the same. The pursuit of truth is of greater value to man than the possession of it would be. The attempts to accomplish a success in the notation of bird songs will exercise the mind and invigorate the spirit, though a satisfactory mathematical solution can never be reached. "A bird in the bush is worth two in the hand," says a modern bird lover. And I say, a song in the ear and in the heart is worth a thousand songs on paper.

Niobe Falls.

(Kaaterskill Creek—Palenville, N. Y.)

BY MARY HAZEN ARNOLD.

Niobe, weird enchantress,
Whene'er I visit thee,
I seem to hear a spirit
Which calls incessantly.

Bright sunbeams kiss thy waters;
Above thee, smile blue skies;
Majestic pines are sentries;
Grand mountains round thee rise.

The tall pines bend to greet thee,

Thou Spirit of the Falls;
Green mosses creep to greet thee;
Huge boulders are thy walls.

Is it a gay child's spirit,
Laughing in merry glee,
Rippling, tripping, dancing—
Eager to be set free?

Or is it spotless maiden,
Her bridal veil of white
In foamy cascades rippling,
All decked in diamonds bright?

Or else a weeping matron,
That will not be consoled,
Looks through a mist of tear-drops
Out on the mountains bold.

Perchance the restless spirit
Of early Indian brave—
O dashing, rushing torrent!
Is hid within thy wave.

Or do thy crystal waters
Confine an ancient sage,
Whose locks of snowy whiteness
Gleam forth from age to age?

Niobe, weird enchantress!
None can resist thy spell;
And dark, o'erhanging mountains
Will guard thy mysteries well.

A naturalist has recently well said:—Mimicry among butterflies, moths and other insects would be comic were it not a matter of life or death. Not a few moths have at the hinder ends of their wings a black mark and two or more tails resembling the horns of their own heads. A veteran in warfare not seldom has these portions missing—proof of the value in having saved his life. Thus the lizard's brittle tail, which, first attracting the enemy, comes off at his touch, lets his would-be prey escape. When at bay crabs distract the enemy by throwing off their claws and lobsters do the trick yet more neatly by seizing the enemy with a claw and then throwing off limb and enemy. Thus the bushy tail of the squirrel is accounted for—there is a chance of escaping the enemy minus only a mouthful of fur.

Some Birds' Nests.

BY THEODORA RICHARDSON.

After each feathery snow-storm of the past winter days when each twig

"Wore ermine too dear for an earl,"

and a deep white coverlid was laid over our cedar-bird's nest on the bough of the garden pear-tree, it brought to mind the nest finds of the past summer days; and made us think that we are again nearing the happy time when feathered songsters will be with us. Will they build in the old site?

All children love to find a bird's nest, and some grown up children experience the same delight.

When a child, my mother lived in a Massachusetts village, on a hillside facing Wachusett. Hardly ten feet from the house was a sapling spruce, in which a pair of robins built one spring. The birds we observed at a distance all the spring, and after they had left the nest, at the close of summer, at the suggestion of her mother, the nest was removed. It was the old-fashioned idea that in so doing, the birds would again build in the same spot. With the next spring, came a pair of robins, and nested in the very same crotch of the spruce, which was about four feet up from the ground, at a point where a ten-year-old could snatch surreptitious peeps when the old bird was away. The removal of the nest, and its building occurred again and again, for five or six consecutive years.

I recently had a talk with a sportsman, who is also a lover of birds. for he guards, "as the apple of his eye," all the tenants of his orchard. He had known that the wood-pewee built somewhere on the north side of his house, and after diligent search located the nest in an apple tree. The succeeding year, when the plaintive note of the little

flycatcher was heard in the orchard, he wondered where the new nest would be placed, and went to hunt for it. Having looked the trees over, he failed to find a new nest. Where was the little mother at last found brooding? On the old nest. The third summer found the wood-pewee back; she tried the old nest for a few days, but it was so shaky that she abandoned it, and built a new one in the next tree.

Last summer, this same friend, discovered a humming-bird's abode in one of his apple trees, and then watched the rearing of her brood. What a rare chance to observe! It reminds me of Torrey's description of the humming-bird babies, of the size of bumble-bees, which he watched one summer. It will be interesting to learn from our orchard owner whether the humming-bird does use the same nest this year. Did such a thing ever happen?

Well, I have wandered from my cedar-bird's nest. It began on Sunday, June 21. It was one of those quiet, sweet, warm, delicious mornings, when the day of rest pervades the spirit with true repose. You can see the trees and shrubs expand beneath the sun's rays; bees and other insects are making music with their busy wings. Our two bird neighbors, dressed apparently alike, in Quaker garb, were first seen inspecting a bit of twine on the pear tree, where a long time before, had hung a bit of suet. Several times, one of the birds made vigorous attacks on the string. He would hang, by his beak, to the end of the twine, and swing for several seconds, like a pendulum, trying to dislodge it. Giving up the attempt, they both made onslaughts on the grape vine, each stripping long ribbons, from six to eight inches in length. We watched to see where the material was being carried.

They flew directly north toward the elm, bordering the street, and then by remarkable cunning, turned each time at right angles to the first course, entering our pear tree.

So skilful were they, that a half hour elapsed before we found the nest. We were so delighted at the prospect of such aristocratic looking neighbors that we wanted to aid in the house building, so we put out blue, red, pink, and white string, and shredded hempen cord. Every scrap was used irrespective of color, or kind.

At the close of day the nest seemed to be finished. This on Sunday, but then they were erratic cedar-birds. But as a cat lived with us, we felt our limitations, and only when the cat was not in the garden did we dare inspect the nest even with the opera glass. The nest, although not more than twenty feet away, was entirely screened from house-view by the leaves. The poor cat's existence was now made miserable, for we hardly allowed him to step his foot into the garden.

The female bird would do a clever thing; when leaving the nest she slipped away on the side from the house, flew to a neighboring elm; there he brought her cherries and other food. A few moments after, the brown tail would again be seen, above the nest's rim; we had watched most carefully but hadn't seen her flight or arrival on the nest.

No further secrecy, on their part, was possible when the brood was hatched. One morning the four very trim but plump birds seemed to so completely fill the nest, that we all prophesied flight before night. One overgrown baby fell out prematurely, and what to do, we didn't know; we feared the cat would see the bird if we tried to assist. So we watched developments. Below the tree were geranium plants, he clambered up one of the tallest of these; then he climbed the rough tree-bark, and by dint of occasional breathings, reached the lowest branch.

There he looked about in a panting condition, fluffed himself up with pride, as if to say, "Well, I did it." Then cocking his head on one side and looking at the depths below, he seemed to shudder, and tottered on his weak

little legs. But before night all had taken wings, to the elm, and who knows but that his mother praised the promising good sense of this first family explorer, and urged the other three to like exertions. Will they return to the same nest? Or shall we remove it as in the case of the robins?

Two years ago we found a wood-thrush's nest in a young pine, about nine feet up, at the junction of four branches with the trunk. The weather destroyed the nest in early August. Last year, at about the same time (May 30), we visited the tree. There in the same spot, and in the same attitude, we found the bird again brooding. It seemed like a beautiful fairy tale, as though no winter winds and snows, and not one hour had intervened.

The oven-bird's and redstart's homes were discovered May 29. The brave little ground builder's nest I have before me; it has a depth of about five inches, is lined with pine needles, and the outer covering is of dry leaves and small twigs; it looked exactly like the surrounding leaf-fall; when first seen it held five eggs. At her front door was a stately brake, like an old English elm before a cottage door; she sat facing the noon-day sun, at her left were two protectors, a hard pine, and a sturdy oak. How jealously we guarded our approach to that nest, lest some wandering boys discover the broken twigs and brakes, and so find the spot. The day following the discovery of the nest, about thirty Institute people were allowed to peep into it, after being sworn to secrecy regarding its whereabouts.

This was unnecessary as they were all bird lovers; some of them afterwards said they could not rediscover it upon trial, however, hunt as they might. What was our alarm to discover, within the next week, that some wretched person had set fire to the dry brush in the near vicinity of the nest; it was extinguished within three feet of the spot.

Mere accident; this saved the brood. Did the mother fear for her brood at that time? When I last visited her I took another party of friends to see the five fledglings. She was covering them when we arrived, but though we were very quiet, the ordeal was too much, and she withdrew, trying to allure us to follow her, as she spread her apparently crippled wings, and walked jerkily away. About five miles away, in another more dense wood, I found a second oven-bird's nest with four eggs in it—my first had five—and this was two weeks later in brooding.

July 5 found us exploring Queen City Park at Burlington, Vermont. As we had but two hours in which to explore, we felt well repaid in seeing or hearing, the parula, pine, blackburnian, the yellow, the chestnut-sided, and black-throated green warblers, Maryland yellow-throat, the goldfinch, sparrows, and other birds common about here. Then a redstart revealed her nest to us, with apparent unconcern, as she settled down into the pocket fastened closely to the side of the gray birch, about fifteen feet up. Only the tip of her beak and a bit of her tail were to be seen,

This reminded us of our bird and nest of May 29. While our nest was in a pasture, this one was swaying above the sparkling waters of Lake Champlain. Truly our eyes find that which we seek.

A later date, July 11, found us on our way from Quebec to Roberval by rail. Our midway stop at noonday is made at Lake Edward, where there is a half hour's wait. A vast wilderness; trees, mountains on all sides, and just here a beautiful lake, one of a chain, along the shores of which winds the railroad, for miles and miles the only link with civilization.

Lonely! In July. What in December? This collection of about five houses, at one of which is served a midday lunch to travelers, was the only pretence for a stop.

Feeling the need of change, we walked up and down the platform until espying swallows, we watched to learn their destination, which proved to be just above the projection of several cottage windows; a good half dozen mud domiciles of the barn swallows were occupied by nearly grown birds, who were as much interested in the noonday insect feast, as humans in theirs

At Tadousac, next day, we took another half hour's walk, There we found Mrs. Red-eyed Vireo swaying and rocking in her hemispherical pocket with as much ease, as those who nest in June in old New England. As we steamed away into the great waters, where the mighty Saguenay and St. Lawrence mingle, I looked back at the bit of woods, and said good-night to the occupant of that cosy nest.

Two Ears.

Once upon a time there was a queer little dwarf named Zekko, who lived in a queer little house behind the waterfall. Everything about Zekko was queer, from the top of his little round head to the bottom of his little flat feet; but the queerest thing about him was that he had only one ear. One was all that he had ever had, so he did not know what he missed, and thought himself as happy as could be.

Zekko had a dog, and the dog, too, had only one ear, which he would perk up in a funny way whenever he heard his master call him; but half the time he did not hear, and that was very bothersome for them both. Zekko had a pet cat, too, who was very fond of him. Poor pussy! she was lean and sickly, because, since she had only one ear, she missed half the mice that she might have caught. Zekko said: "The cat is lazy," and he bought only enough food for himself, the dog and the donkey. The donkey was not so great a comfort as he might have been, because, having only one ear like the rest of the family, he often made mistakes, such as going fast when he was told to go slow, and stopping when he was told to go on.

One lovely day in spring, Zekko decided to ride down the valley

to buy some food. All there was left in the house was a tiny piece of meat, which he threw to the cat, saying: "Pussy, pussy, here is a great treat for you!" But pussy had her one ear turned the other way, and did not hear him; neither did she hear a little mouse that was nibbling in the wall close beside her. So she sat still, licking her hungry chops. The dog lay before the fire, fast asleep. "Come, come, old fellow! You may go, too," called Zekko. But the dog's one ear was under his head, and he could not hear. Sorry enough he was when he awoke and found that his master had gone off without him.

"Now," said Zekko, as he jumped on his donkey's back, "take me down the valley." But the donkey thought that Zekko said: "Now take me up to the top of the mountain;" so up the mountain he went, and his mastar could not stop him. Zekko had never been anywhere except down the valley and back by a road that ran along the bank of a rushing river. And so it happened that he had never heard the birds sing, for in the morning when he went down, his ear was turned toward the roaring water; and although, when he came back, his ear was turned toward the woods, by that time evening had always come and the birds were asleep with their heads under their wings.

Now, as he rode up the mountain, he heard for the first time the sweet singing of the birds, and he was so enchanted by it that he forgot all about the food which he had intended to buy, and stayed on the mountain all day.

The next morning very early, before the cat and dog were up, he started on his important errand. This time he was careful to talk into the donkey's ear, so that there could be no mistake; for, although he would much rather go up the mountain to hear the birds sing than down the valley to buy food, he knew that he must not starve himself, his dog, and his donkey.

But as he rode along by the river it suddenly occurred to him that the birds might be singing in the woods—indeed, it was more than likely. How charming it would be to hear them! Oh, if he only had an ear on that side of his head! Why was he not born with two ears instead of one? So he longed for an ear, and longed and longed, all the way down the valley, until just as he reached the end—wonder of wonders!—a little ear had begun to grow just where there ought to be one. Every time he rode down the valley he listened so hard to hear the birds singing, that by the end of the week his new ear had grown as big as his old one.

Then he began to take walks through the woods all by himself.

"My donkey is so contrary that I can't ride him for pleasnre,' he would say, "and my dog is so stupid that he would surely get lost. Of course, my cat wouldn't care to go. What a lazy old cat she is!"

And so it happened that as he wandered about listening to the birds his two ears grew very sharp, so sharp, indeed, that finally he heard a great deal that was worth hearing besides the songs of the birds. He heard the crickets chirping and the bees humming, the whirr of the locusts' wings and the laughter of the brooks, the rustling of the leaves in the wind and the crackling of the twigs under his feet.

"Oh, the world is full of music," he would say. "How glad I am of my two ears!"

Those days, so happy for Zekko, were hard for the rest of the family, who felt sad and lonely with their master gone so much; and every night they groaned and moaned and sighed in their sleep. But Zekko did not hear them (for his ears were not yet as sharp as they might be), until at last one night, when he was lying awake in his bed listening to the music of the great waterfall, which had never seemed so grand before, he began to think about the other three. The more he thought about them the more he pitied them; and the more he pitied them, the sharper grew his ears—so sharp, in fact, that above the roar of the waterfall he could hear the donkey in the shed, and the dog at the foot of the bed, and the cat lying on the mat, all tossing about uneasily and talking in their sleep. The donkey was groaning: "He thinks me contrary, but alas! I have only one ear." The dog was moaning: "He thinks me stupid, but alas! I have only one ear." And the cat was sighing: "He thinks me lazy, but alas! I have only one ear."

Then Zekko was ashamed to think how cruel he had been to the rest of the family, and he wished that he might help them. He remembered how a good fairy, who lived a hundred miles beyond the mountain, had come to him once and promised to give him anything he might need for others, but it must be something he could not buy. It had never occurred to Zekko before that the poor cretures who lived with him needed anything besides food, but now he knew that they wanted two ears as well as he.

The next day he went off on his long journey, walking all the way so that what he brought back might be a joyful surprise to the the donkey as well as the rest. A hundred miles beyond the mountain the fairy was waiting for him with a bag in her hand.

"I am glad you have come at last," she said, "to get something for somebody. Here are treasures that cannot be bought."

Zekko took the bag and peeped in. Exactly what he wanted! There was a long, stiff, hairy ear, a limp, soft, silky ear, and a little smooth, furry ear.

When Zekko reached home late at night and found the unhappy animals tossing uneasily in their beds, he crept about noiselessly and fastened each ear on the right head in just the proper way, blessing the good fairy for giving him in each case such a perfect match. Can you imagine what a beautiful surprise it would be to waken in the morning with two ears after going to sleep with only one?

The donkey was delighted now to take his master about on the mountain, going precisely where he was told to go, for now he understood every word that Zekko said. The dog went too, and a merry time he had, chasing woodchucks and squirrels, without a fear of being lost, for he could always hear his master when he whistled. The cat stayed at home, of course, and kept the house free from mice. Not one could escape her now, and she grew as sleek and fat as every good pussy-cat ought to be. From that time on the donkey was always obedient, the dog followed his master faithfully wherever he went, and the cat was busy from morning till night at home. And so in the queer little house behind the waterfall they all lived together, a Happy Family forever after.

Nature Study Lessons. XI.

BY EDWARD J. BURNHAM.

In almost any collection of insects made from brooks and ponds in New England and the Middle States, there is sure to be an assortment of caddis-fly larvæ. These industrious creatures are easily kept in any sort of receptacle that will hold water, and if supplied with brook weed, tiny sticks or leaves and stems of water plants, will go on busily and contentedly building their houses for days and even weeks. For those kinds which live in still pools with muddy bottoms, the water in the aquarium need not be renewed more frequently than once a day, and then only

in part. Nymphs of may-flies, of most dragon-flies and many water beetles and water bugs will live under the same conditions, so that an aquarium for ordinary observation is easily kept, and there ought to be one of some kind in every school room, at least for a few weeks in the spring.

One of the most common of the caddis-fly larvæ builds his house of bits of sticks or grass which he cuts in short pieces with his jaws and lays crosswise, as children in the country used to build cob houses. They are busy builders and work almost constantly, but with very little judgment or common sense. We supplied abundance of material for one of these builders by cutting off bits from the ends of matches. He worked fast, and soon had a much larger house than he needed. Worse still, being made of dry match-wood, he could not make it sink ; and, worst of all, as the dry wood was wholly at one end, the house stood persistently upright, despite his frantic efforts to tip it over. He would lean far over one side and try to swim downward, but his house had become a ship and still floated right side up—or, rather, wrong side up for him. It never occurred to him to gnaw off the silken threads with which he had fastened his lumber together, and so let some of it drift away. At night, when we left him, he was wildly brandishing his six legs, but making no use of the sharp jaws which would soon have set him and his house right again. In the morning he lay dead at the bottom of the aquarium, while his useless house floated above him.

Dragon-fly nymphs add greatly to the interest of an aquarium. They differ widely in their habits. Some will climb up a stick to the surface ; some bury themselves in the mud, and others prefer to work themselves backward in clear sand until only their eyes are visible. All are voracious, but they are also wonderfully patient and will

wait motionless for hours, and even days. Then, as some insect or other small creature comes near, the queer double-jointed lower jaw is thrust out and as quickly brought back, with the victim secure.

But the dragon-fly nymph, if very hungry, will go in pursuit of prey. Our aquarium was once greatly reduced by the larger insects eating the smaller. The may-fly nymphs had disappeared, and, save a few hard-shelled beetles, there remained only a dragon-fly nymph and a large caddis-fly larva, of the kind that makes a tube of the thin covering of water plants, which he rolls up and unites in sections, much as waterpipe is joined.

We saw the dragon-fly snap at the head of the caddis-fly. He missed, but evidently there was to be a battle, as in real life in the water. We covered the bottom of a deep plate with white sand, filled it with water, and placed the two insects in it, that they might have a fair field and we a clear view.

The dragon-fly remained still a long time. The caddis-fly put his head out and looked about; then he put out his six legs and began to draw his long house over the sand. He had hooks at the end of his body, with which he could hold to the silk lining, and he also had a hump with a sharp spine on his back. With this and the hooks to hold by, he was safe from being dragged out. The dragon-fly came and snapped at him, but the jaws slid off the hard, round head. This happened as often as the caddis-fly put his head out. At last he resorted to strategy. He turned around in his house and, coming partly out at the other end, slowly worked himself and his shelter behind and alongside the dragon-fly. Then there was such commotion in the sand that we could see nothing. When it cleared, the caddis-fly had the dragon-fly fast and had already gnawed a hole in the shell, back of the right fore leg. Pushing his head far in, he ate greedily. In half an hour the empty shell floated to the surface, while the caddis-fly retired to his house and remained perfectly still all day.

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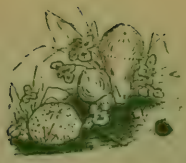

NATURE STUDY.

A monthly magazine, published under the auspices of the Manchester Institute of Arts and Sciences. EDITOR: Edward J. Burnham. ASSOCIATE EDITORS: Frederick W. Batchelder, William H. Huse, Susy C. Fogg, Theodora Richardson.

Devoted to the encouragement of the study of Nature in her varied aspects—of the Rocks, the Birds, the Flowers, and all the multitude of living things that crawl or swim, or walk or fly.

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NATURE STUDY PRESS, Manchester, N. H.

Entered as Second-Class matter at the Post Office at Manchester, N. H.

TIPPING ROCKS, GOFFSTOWN, N. H.

PHOTOGRAPHED BY W. H. HUSE.

NATURE STUDY.

PUBLISHED UNDER THE AUSPICES OF THE

Manchester Institute of Arts and Sciences.

VOL. III. May, 1903. NO. 12.

Tipping Rocks.

Among the most interesting relics left by the ice age are the tipping rocks, large bowlders poised so evenly and balanced so nicely upon the ledge below that they can be rocked, sometimes by the hand alone. These huge rocks were in some cases let down gently by the melting ice and chanced to rest upon an angle that would allow the slight rocking of a mass weighing perhaps hundreds of tons.

It is probable that in some rocks weathering has been the cause of this phenomenon. The portions of the rock resting rather lightly against the ledge below would be kept constantly moist and thus would decay faster than those parts that dried more quickly or that portion where the pressure of the entire mass would prevent to some extent the entrance of water and the gases of the atmosphere.

Sometimes a bowlder that has been split by frost has one of the fragments nicely enough balanced to be rocked by the application of human strength. This adds to its uniqueness, for while it all happened so, it is happenings that make curiosities. A rocking bowlder of this latter class is the tipping rock of Shirley Hill in Goffstown, N.

H., a few miles west of Manchester. Split open ages ago by the frosts of winter, the fragment represented at the left in the frontispiece chanced to be poised so nicely that it can be rocked, one way by hand, the other by means of a small lever. The rock is one of the attractions of the vicinity and has entertained thousands of visitors.

The Solitary Walk in the Country.

BY MARY-LEE VAN HOOK.

If one wants to observe Nature for himself the solitary walk is the most valuable. The companionship of a congenial friend is always delightful, but how quickly the character of a walk may be changed by the conversation one is tempted to pursue! If Caliban should say to us as he did to Trinculo:

> "I prithee, let me bring thee to where crabs grow;
> And I, with my long nails, will dig thee pig-nuts;
> Show thee a jay's nest, and instruct thee how
> To snare the nimble marmoset; I'll bring thee
> To clustering filberts; and sometimes I'll get thee
> Young sea-mells from the rock. Wilt thou go with me?"

I think we should go. But any less wild and woodsy a creature than this would surely distract us from our real purpose, which is to learn as much as we can about the wild things that grow or stir about us.

To see the little animals at their best, the birds and the squirrels, is not to find them terrified and fleeing from us, their enemies, but to watch them going about the ordinary course of their business. It is possible so to watch them, sometimes for long periods, if we adopt some of the ways of the animals themselves. You have watched a robin when he hears a noise and seen how still he becomes, how he tilts his head to one side and listens; often a worm, if touched, will become rigid, as if dead. By sitting down

on a log and remaining as quiet, one can really study the animals, sometimes without their knowledge, sometimes even with their consent.

The most advantage comes to one, I think, from a walk in the country. The city parks are beautiful and we can learn much about the trees and shrubs that grow in such profusion; or about the birds that find their homes there. But, after all, what a different effect one gets from a walk in the country. Even if it is not the real country but only a woodsy bit in the outskirts of the city, perhaps by a river or small lake.

The thought that there, everything is as Nature intended it to be, that there has been no interference from the hand of man, no matter how artistic, is in itself a stimulating idea. Then the joy of bringing home a few trophies! —a handful of acorns, a branch of pine with a few cones on it, a clump of bluets or anemones. Such a bunch planted in a pretty dish and kept moist will make for the table a dainty center piece for a long time. In the parks there is a pleasure and a duty in loving the wood rose and leaving it on its stalk; but when we are in the country, let's take home a few.

The psychologists tell us that people do not see anything but that of which they have already some mental conception. Certainly we all know that after we first learn of a fact, we immediately hear of it on every side. It follows, then, if our minds are filled with images of things we wish to see, that we shall be more apt to see them. This condition of mind would not, of course, preclude surprises on the walk, the seeing of things we had not expected to see on that day.

In the spring of the year, after the warm rains, millions of seeds begin to germinate or sprout. If, on starting for a walk, one had in mind the single concept, seedlings, he

would be astonished at the numbers he would see. Under a maple tree, for instance, thousands of seeds are to be seen in the various stages of germination. Quantities of key-shaped seeds drop from the sugar maple in the fall, lie dormant all winter, and germinate in the spring.

The seed is well protected by an outer coat, the testa. A tiny plant, the embryo, is curled up inside; in the sugar maple completely filling the space. The embryo consists of two long seed-leaves, the cotyledons, and the little stem, or caudicle. When the seed begins to germinate, the stem lengthens, and the cotyledons are carried up out of the ground, bearing aloft the bursted seed coat. At the same time the root begins to grow, and soon securely fixes the young plant.

The cotyledons never perform the work of real leaves, but are merely the stores of nourishment for the young plant. In between the cotyledons is a little bud, a plumule, from which the second pair of leaves grow. After these are formed, the cotyledons, having finally exhausted their store of food, wither and die.

The waste, or rather the profligacy of nature, is exemplified well in the case of the seedlings. Consider the numbers of seeds that are lost, that a few may live! For it is with plants as with the human family, the mortality is greatest during infancy. It has been computed that a single plant of the common shepherd's purse, capsella, produces as many as 12,000 seeds; and the purslane, 40,000. Of course only a very few of these seeds will come to maturity, some being destroyed during the seed stage, others after they have become seedlings.

All Phanerogams, or flowering plants, are grown from the seed, the product of the flower. The shape and size of the seed, its method of distribution, the time that it takes to germinate, all vary to a great extent. To note these differences, to try to account for them, and finally to

bring home seeds and seedlings for simple experiments; surely this is a pleasant object for a walk.

Chicago Ill., April 20, 1903.

Growing Trees from Seed.

Those who know of John Bartram, the first American botanist, and are familiar with that wonderfully varied and interesting correspondence which was maintained between him and Peter Collinson for so many years, will remember the eagerness with which the latter and his friend, Lord Petre, awaited consignments of seeds from America. So long as Lord Petre lived, a sum of money was made up annually for Bartram, to enable him to devote a portion of his time to collecting the seeds and nuts of forest trees, and whenever a box containing packages of them arrived in London, there was sure to be a gathering of choice and congenial spirits—noblemen, botanists, trades-people, brought together by a common interest in the packets, to examine their contents, to read Bartram's descriptions of the trees and shrubs that bore the seeds, and to share in the generous distribution of them. No one who has read Dr. Darlington's collection of the Bartram-Collinson correspondence will forget Collinson's repeated and plaintive appeal for chinquapins.

We now leave to the seedsmen much of the work in this direction done by Bartram and his London friends, but we miss something in interest and value by doing so. There is a pleasure in watching the growth of a tree or shrub from a seed planted by our own hands, such as the transplanting of a seedling cannot give, and when it is rare or from a distance, the interest is, of course, greatly enhanced. It is all much easier now than in Peter Collinson's time. Not only can seeds be readily obtained by correspondence, or through some friend who is on a tour for health or

pleasure, but the parks and commons, even in the smaller cities, usually present a considerable variety of trees and shrubs from which seeds may be obtained at the proper season, with almost no trouble at all.

In her "Garden Notes," in the Hartford *Times*, Mrs. Wilhelmina Seliger tells interestingly of her experience with seeds which she collected in a park in her city. The following extract from the "Notes" is suggestive of possibilities for other nature lovers, and for teachers and pupils in the use of some portion of their school grounds.

"It is fascinating," writes Mrs. Seliger, "to raise trees from seed, and shrubs also. I have quite a number of them, various kinds, the specimens I gathered by chance in Bushnell Park. There are now growing two honey locust trees, two Kentucky coffee trees, several gingkos, a red-flowered horsechestnut, whose leaves in unfolding have a dard red color, as a contrast to the light green of ordinary trees of this kind. Then I have a hawthorne and a barberry bush, a spice bush, and several oaks and nuts. All have stood well several winters, but are small yet. Seeds of more are not yet up, and some are not in the ground yet, as I feared a night frost might kill them in our exposed locality. There are *Pinus ponderosa* from the state of Washington and *Sequoia sempervirens*, the California redwood. Of this latter an authority told me it is not hardy here, but *Sequoia gigantea* is. Seed of this is not to be had, and young seedlings cost from one to two dollars apiece. A Persian walnut six or seven years old from the seed, better known as the English walnut, I encase every winter in old bagging; perhaps it will not grow old and may never bear nuts, but then I had every season of its life the pleasure of seeing it sprout out very late, and inhaling the strong scent of its leaves. In northern Germany these walnut trees are found near the houses of many farms and also in city yards. They pay well for their raising, and are also a special favorite for the home."

Nature's Sand Table.

BY WILLIAM H. HUSE.

The modern teacher of geography has a sand table and uses it to illustrate land features. Its relief shows better than any flat engraving the various forms that can be modeled on it. Aside from this the experience of the child in producing for himself the different forms will fix the facts in his memory better than any other way that can be devised. This last feature of the work can be improved upon only at the edge of brook or pool where real and not imaginary water is at hand, but this is attended by some inconveniences. There is, however, an advantage in studying land and water features and all physical geography facts in the open air that cannot be found elsewhere. The pupils of city schools are mostly denied the rare privilege of field lessons, but the country scholar lives in the midst of opportunites abundant and valuable.

To be able to rattle off, parrot-like the definition of a land or water form without the ability to recognize that form on the way to school should be regarded as *prima facie* evidence of crime on the part of the teacher, yet this is done. In the country schools where the opportunities are the most abundant are the worst offences committed. This is not to be wondered at when in too many towns the teachers are paid less than they could earn doing house work in the city. It is little wonder that there the book fetich clings most to school work. The world moves, however, and it behooves us to join the procession.

Now is the time to work at nature's sand table and water tank as well. The vegetation that has slept so long is awaking, suggestive of many things that are mentioned in textbooks the words of whose mentioning are so ignorantly committed to memory. The life of distant lands is represented by kindred forms at our feet.

The study of home geography should include the birds, the bees, the flowers and leaves and all the multidude of living things that make the spring so beautiful and the summer so glad. Hills and mountains, lakes and rivers, brooks and springs are at our service and can reach many a boy whose mind is impervious to book lore.

From now till nature begins to slumber in the fall is the geography teacher's opportunity. Not all the time can be spent in the open air. School committees would not allow and too much time would not be profitable. There are other things to be studied besides geography, and they need books and paper and desks. There is little danger, however, of overdoing this matter under present conditions. To teach where nature is, is a privilege. To lead the young mind to a love of nature and to a knowledge of her secrets is a duty. Happy is the teacher whose work is near nature's sand table.

The Bluebird Recoupment.

Central Park bird students began work fully two weeks earlier this year than ever before. The warm days and fair skies of March brought the birds back from the south in unprecedented numbers for so early in the season, and every pleasant morning nowadays amateur ornithologists, notebooks in hand, can be seen sometimes as early as five o'clock hovering near the wooded sections carefully observing the movements of the songsters.

The feature of the spring has been the reappearance in numbers unknown since 1894 of the bluebirds. This, in addition to being a gratification to lovers of this daintiest of birds, was of value to science, in that it showed the bluebird as occupying a sort of especial niche in the bird world that could not be filled by any other of the feathered tribe. In 1895 the blizzard which swept the south all but annihilated the bluebirds. Continued storms prevented the birds from securing food, and they died by thousands. The few remaining ones, however, have since been able with their progeny

to bring the visible supply of bluebirds up numerically to the point held prior to the death-dealing storm.

Frank S. Chapman, of the American Museum of Natural History, accounts for the apparently wonderful recovery of the bluebirds by the fact that they are indispensable to nature and that no other bird could in the period of their scarcity take their place in the scheme of bird life. In this connection Mr. Chapman said the other day:

"The bluebird is practically restored to the position he held prior to the destructive blizzard of 1895. He is again vigorous and plentiful, and the fear entertained at that time that he was to be accounted among the rarities has been more than discounted. It was not until this year, however, that the birds have been recruited up to their full standard. It has taken just eight years for their recoupment."

Central Park, the oasis of green in a desert of city buildings, is declared by those who know to be among the best possible places for the study of bird life and habits. Because of its position more birds gather there than in five times the space in the open country, and this accounts for the constantly increasing number of students who avail themselves of its opportunities.—*New York Evening Post.*

A Prairie Pet.

I have rarely seen an animal of any kind that could be made a pet of without trying to get one of them to experiment on. The prairie dog was one that I at last got. I at first tried to drown them out of their burrows in spring, when I thought there would be young ones among them; but pouring water in one of these holes is much like pouring it into a rat hole. Their burrows would sometimes get flooded in a heavy rain, and then I could catch them and get my hands bitten all over. They have teeth sharp as needles, and they know how to use them. I caught an old one, a male, and putting a cord round his neck, brought him home and staked him out on the grass. In a short time he began to dig a hole; he meant to stay. I let him keep at work on it a while, then took the cord off his neck. He put down a slanting hole about three feet long, with a small chamber at the bottom; then made his bed in the chamber, using dead grass for a bed. I got him hay and excelsior, and he used these to make his bed. Every week or two I would

have a fresh lot near his hole; then he would rake out the old bed and make a new one. I fed him cabbage leaves, the tops of vegetables out of the garden, sugar, and, when I could get it, an apple once in a while. Apples were what he wanted, but I could not often get them, and they cost me five cents apiece when they could be got, so he did not often get any. He would sit up on his hind legs and take sugar out of my hand, but would never let me touch him.

It is generally thought that these dogs live without water; it is true that their towns are often found miles from any surface water; but I have always thought that one burrow at least in each town was sunk far enough to reach the water. They certainly use it—mine did. I kept a tin can sunk in the ground near his hole with water in it; he would drink the water, then sit at the can, dipping his paws in it; but I never saw him wash as some animals do.

He was kept for eighteen months; then we were ordered away, and he was so tame now that if I left him behind he would be killed sooner or later when I was not there to prevent it, so I got him into a basket, then carried him back to the town I had taken him out of, and turned him loose in it.—*Forest and Stream.*

I have not learning enough to know whether in the earliest times ravens were accounted "unlucky." If so, why were they chosen from among all the birds of the air for the merciful errand of carrying bread to Elijah in the wilderness? Did they steal it? They are given to theft!

Also, in the written word we are assured that "God heareth the ravens when they cry out unto him." And nothing of this is said of doves or of any other white or heavenly kind of bird. An explanation is given in the Egyptian commentary on St. Luke in the Coptic script by Epiphanius, A. D. 368–401. The passage is certainly very curious, and I am permitted to transcribe it here:

"Why, then, did the evangelist mention no name among the birds except ravens only? Because the hen raven, having laid her eggs and hatched her young, is wont to fly away and leave them on account of the hue of their color, for when hatched they are red in appearance. Then the Nourisher of all creation sends to them a little swarm of insects, putting it by their nest, and thus the little ravens are fed until the color of their body is, as it were, dyed and becomes black. But after seven days the old ravens return, and, seeing that the bodies of their young have become perfectly like their own, henceforward they take to them and bring them food of their own accord."

It is for naturalists to ascertain whether or no this strange account of the young ravens holds good in our day.—*Cornhill Magazine.*

The American Eagle.

The following dissertation on the American eagle was a contribution sent in competition for a prize offered for the best essay on birds some time ago. The conditions of the contest were that the composition should be original and the result of personal observation. The essay, which is reproduced verbatim, speaks for itself:

The american eagle is a bird of the heavens, because they fly almost of the time. He is the king of the day. He is a majestic bird. He represents an Emblem of our native land. He is doomed to stand among the nations. He gives us the joyous shout of liberty. He spreads his wings and dares a soaring far and long though tempest may blow. He will not quail, Kings and nobles come from distant lands to seek the shelter of his wings, He is proud sailing in the heavens; Oh! may our country keep their eye on him. Proud eagle of the rocky wild,, He has also been known to pick up children from seven to ten years, and carry them quite a distance and although they fly so very high, they never forget their young. If they are not strong enough to get away he will tear them and pick them to pieces with their long and sharp bill and claws.

Birds and Their Tails.

Birds have not always had the graceful fan-like bunch of feathers which is the typical form of tail of most living species. Their ancestors, the lizard-like birds, trailed long appendages, composed of many little bones, or vertebræ, with a pair of perfectly developed feathers growing from each separate piece of the backbone.

If we look at the skeleton of a sparrow or dove we will see at the tail end of the spinal column a curious wedge-shaped bone, which is known as the ploughshare bone. This is all that is left of the lizard tail, but the rest of the appendage, in the course of evolution through the ages, has not dropped off, nor, like the tail of the pollywog, has it been absorbed. It has been telescoped or crowded together, the bones nearer the body bulging out slightly on either

side. So, at the present day, tail feathers grow, not like the webs on the shaft of a feather, but fan-like, from a composite mass of bone.

Now that we have evolved our modern bird's tail, let us see to what uses it may be put, and a fine place to do this is in the New York Zoological Park. Of course, its use as an aid to flight is the first thought that comes to our mind, and rightly, too, for the parts which it plays in this respect in various birds are many. The tail is used as a rudder, especially when it is long and powerful, enabling birds such as tropic birds and magpies to make quick turns in the air. Tails sometimes perform the function of brakes. When a great pelican settles gradually towards the surface of the water, the tail, widespread and lowered, is of great importance in regulating the shock of alighting. The tail is aided in this function of brake by the great expanse of web between the toes, both feet being comically stretched out in front.

Birds which have very short tails are unable to turn quickly, and their flight is very direct, or even when there is a long tail, if it is principally for an ornament and not well muscled, it is of little use in helping its owner to change the direction of flight.

Among many other uses of tails we must mention props. Woodpeckers and creepers really sit on their tails, the feathers of which are stiffened, and with just enough resistance at their tips to admit of their bending into and making use of every crevice in the bark. As we watch a brown creeper hop rapidly up a tree trunk, never missing a foothold, no matter what smooth places it may encounter, we say to ourselves how impossible this mode of progression would be without the all important caudal appendage. But here, as everywhere, Nature confronts us with surprises. Our natural philosophers tell us that the law of gravitation is universal, and yet in almost any grove of trees in winter we will find what are apparent exceptions. Associated with the brown creepers, little blue and white birds will often be seen—nuthatches—which run and hop merrily over the branches, upside down, wrong side up, any way, any place which promises an insect tidbit. And most wonderful of all, it is only by means of their eight little claws that they do this. The rather short tail is often bent far forward over the back, and in every case never touches the bark.

Even the innate characteristics of birds are often portrayed in the manner of carrying the tail; quiet, soft mannered birds carrying it low beneath the wing tips, while active, nervous species carry it more or less raised. The peacock's real tail consists of small brown feathers which serve as a support to the magnificent train of feathers growing from the lower back.

The motmots, birds of Central and South America, not satisfied with having long decorative tail feathers, proceed to embellish further, and when full grown pull off the barbs from a portion of each of these feathers, leaving a rounded disk at the tip. Even birds which have been reared from the nest carry out this habit through inheritance. The males of certain weaver birds—the widow finches—have very elegant tails, much longer than their bodies. And most gracefully do they carry them, flying through thick foliage without injuring their long trains in the least.

In some birds, as in our meadow lark and vesper sparrow, the central feathers of the tail are protectively colored, and when the bird is at rest help to conceal it from observation. The minute these birds take wing, the pure white outer feathers flash out conspicuously. It is said these are like the "cotton tail" of the rabbit—a signal to its young, or to other members of the flock, to follow and escape, the older and more experienced birds being stronger, and, therefore, usually in the lead.

The tinamous of South America has no tail at all.—*C. William Beebe, in New York Evening Post.*

Animals' Playthings.

"Animals' games and playthings form a great division of the Institute's research," said a member of the Paris Institute of Zoology. "It is a great subject. Within the past year two serious books have been written on it, one in French and one in German. Peschuel-Losche tells of a tame female monkey who constructed a swing for herself, measuring the rope and changing its length several times before it suited her. The observer, Fr. Ellendorf, had a little black-headed monkey who amused himself by striking safety matches on the edge of the box. The same naturalist, Losche, tells how young baboons make playthings of pieces of wood of peculiar shape, and when going to bed at night, like children, they go to sleep holding them in their arms.

"Isabelle," one of the most intelligent of these baboons," he says, "thus cherished for a long time a sardine box, which she had polished until if shone like silver, and Pavy, her brother, clung to a curved piece of wood with which he played tipcat. Both puppies and kittens put in their time with playthings, which the former, at least, hide carefully away at night."—*Paris Letter, in Washington Star.*

The Struggle for Existence.

BY EDWARD J. BURNHAM.

A quotation from Professor Chapman, on another page of this number of NATURE STUDY, with reference to the increase of bluebirds since the great destruction caused by the "freeze" in the South a few years ago, suggests anew the thought of the terrific struggle for existence which, under normal conditions, goes on throughout all nature. There is, indeed, no plant or animal, however slow the rate of increase may be, which would not in time over-run the entire earth if not restrained by barriers which it cannot pass and checks from which it cannot escape.

The bluebirds suffered so severely in the South in the winter of 1895—probably more from lack of food caused by sleet and ice than from actual cold—that they were extremely rare for several seasons, but now, after eight years, they are apparently as abundant as ever. This fact indicates that the bluebird is less restricted by enemies than by want of food. When few in number, food is sufficient and it increases rapidly, but the time inevitably comes when the limit has been reached, and from that time on there must be a constant search for food and an increasing struggle, not with other birds and animals, but among themselves—a struggle which means starvation for those not strong enough to survive.

This struggle for existence, with its attendant destruction of life, is the most pathetic thing in nature. We may not hope to understand it, or to see how it can accord with our ideas of mercy and compassion. We only know that it is a fact, and that by means of it, through long ages, have come the strength of wing, the fleetness of foot, the sharpness of eye, the beauty of color and song among the creatures of the woods and fields, the earth and air.

It is obvious that when once the natural limit of any creature has been reached, as many must perish each year as are produced in that year. Otherwise the increase would go on indefinitely. A little computation will show how great this yearly destruction among the bluebirds must be. Bluebirds lay from four to six eggs for a brood, and rear two broods a year. It is claimed that sometimes they are even three-brooded. Now assume the number of eggs to be five, which must be a fair average, and the broods to be two. By reason of the nesting habits of the bluebird, relatively few eggs fail to produce a chick. But, that we may be conservative, let us assume that each pair of bluebirds produces eight young in a season. In a section, then, where there were 1000 bluebirds in the spring, there would be 4000 young in the fall, or 5000 bluebirds in all. If it were possible that these might all migrate safely and return the next spring, to produce at the rate of the previous year, there would be 20,000 young, which, added to the 5000 parent birds, would give a total of 25,000 bluebirds ready for migration the second fall.

This rapid rate of increase explains how it is that the bluebirds have so quickly come to their own again after the terrible calamity of 1895, and indicates, also, how great the yearly destruction must inevitably be after the normal numerical limit has been reached. Some of the old, many of the young, must perish—as many of old and young as shall equal the number hatched each year.

This fact—for obviously it is a fact, however disagreeable it may appear—shows what must be the potency of natural selection in this terrific struggle for existence. Anything that tends in the slightest degree to the advantage of an individual will tend to enable that individual to survive, and if it survives, it may transmit its characteristics to its young. A sweet note, a brilliant plumage, a gallant bearing may help to win a mate; strength, fleet-

ness, keenness of vision, color protection, will help in the search for food or in the escape from enemies; and we find evidences of this special fitness that has come from natural selection—another term for adaptation—on every hand. It adds greatly to the interest of every walk or ride, when once we have come to think about it, and our eyes are opened so that we see.

A Collection of Fleas.

The safe arrival of the whaler Forget-Me-Not at Sidney, Cape Breton, and the report that her captain has been intrusted with the task of obtaining specimens of arctic fleas for Charles Rothschild, suggested a visit to Tring Park, where thousands upon thousands of fleas are kept in his famous zoological museum. Dr. Jordan is in charge of the museum. There were cabinets containing fleas of all forms and sizes from nearly every corner of the world. They number 10,000 or more.

"Every mammal and bird has a particular kind of flea," said the doctor. "Very many have several different kinds. Thus it appears that the cat flea is different from the dog flea, and the dog flea from the sparrow flea. Each in turn is different from *Pulex irritationis*, the scientists' pet name for the human flea. So you see," observed Dr. Jordan, "that the flea affords more diverse matter for a collection than does any other living creature."

He than produced some of the gems of the collection. One, the mole flea, is the largest specimen known. He is one-fifth of an inch in length and is named *Hypstrichopsylla talpæ*. Another, the most injurious of all fleas, is known as the chigoe or sand flea. Still another is a flea with claws like those of the lobster, which is found on a small South American bird.

Mr. Rothschild collects his fleas vicariously through agents. Whenever any expedition is about to start for a protracted journey to a foreign land he engages one of the party to collect species of fleas from mammals or birds that

are captured. He supplies vials of chloroform and labels, and specimens reach Tring labeled with the name of the creature on which they are found. They are then classified, hermetically sealed and packed away with thousands of their mummified brothers.

A specimen in the collection from a point nearest either pole is a flea from Kerguelen Islands, in Antarctica, but Mr. Rothschild is anxious to have fleas from the blue fox, the polar bear, the Eskimo dog and other arctic animals. So it came about that the captain of the Forget-Me-Not received a commission to hunt the arctic flea.—*London Dispatch in Chicago Record-Herold.*

Nature Study Lessons. XII.

BY EDWARD J. BURNHAM.

Insects present special advantages for those who would help children in their attempts at nature study. In many respects they are to be preferred to flowers and birds, although these, of course, should not be neglected. Plants are in bloom but a short time each year, and it is not always easy to interest children in roots, stalks and leaves. Indeed, when the plants are in bloom, children are not apt to be greatly impressed by the difference in number of stamens and pistils or the shape and character of the style. As a rule, birds must be studied at long range, and one must be content with snatches of song and occasional glimpses of the songster. The study of birds and flowers is adapted to people of mature years rather than to very small children.

Insects, on the other hand, are easily captured, most of them may be safely handled, they are abundant everywhere, and are to be found in some stage of development at every season of the year. In addition to these advantages, there are few other objects in nature that interest children so keenly, and at the same time yield so readily

to attempts at classification—and every child delights in classification, so long as it is free from drudgery. The child, even when wholly unaided, finds pleasure in observing what one creature has that another creature lacks —and this is classification. With insects the differences among the major groups are generally so obvious from external characters as to make recognition and separation easy.

Suggest to the children that they catch a considerable number of all sorts of creatures that look like insects. They will need no urging. The creatures having been killed by means of a "cyanide bottle," with chloroform, or any of the expedients now familiar to most teachers and parents, let them be placed in a mass upon the table at home or in the schoolroom, or better still, upon a newspaper spread on the grass in the field.

Now let the children compare, select, and arrange in groups in their own way. It is surprising, what they can do without a suggestion from a teacher. In a short time, with keen eyes and nimble fingers, they will have the butterflies and moths in one pile, the beetles in another; a separate pile for the grasshoppers, and almost surely another for the flies, although at first the flies and the bees are likely to get mixed.

When the children have made as many divisions as they can give reasons for, the teacher may venture a suggestion occasionally, still leaving the young folks to do most of the thinking and all of the work. Probably some brown, flat creatures have been gathered from under fallen leaves and decaying wood. Let the children place these in a pile by themselves, after counting their many pairs of legs. These are centipedes, and they have one pair of legs on each joint of their many-jointed bodies. There may be another creature, somewhat like the centipede, but with a round body and two pairs of legs on each joint. This is a

millipede, or "thousand legs," as the centipede is called a "hundred legs," although I suppose it never has quite so many as that. "Thousand legs" and "hundred legs" may be put near together, or in the same pile, for they are a sort of cousins—very queer, old-fashioned cousins, too, who have not changed their ways for a thousand years, and more—not even since the time when the coal was made, and that is longer ago than anybody can remember.

Of course there will be some spiders in the collection, and perhaps some harvestmen, or "daddy-long-legs." The children will at first almost surely think the spiders have five pairs of legs, but if they look sharp they will find that the front pair, which look like legs, have a different number of joints from the true legs. In reality, they are not legs at all, but feelers. So the spiders have eight legs, and as the harvestmen have eight legs also, they may be put in the same pile, or near it, for they are cousins to the spiders.

Now count the legs on the beetles, the butterflies, the bees, the flies, the crickets and the grasshoppers. All these and many other creatures have six legs, and are known as the true insects, but they differ widely among themselves. Some have two pairs of wings, some have one pair, and some have no wings at all. Some of these insects with four wings have the front and hind pairs almost alike, some have them alike in texture but unlike in shape, and some have the front pair leathery, while in others the front pair have given way to hard and horny wing-covers.

Some insects have jaws that they bite and chew with, moving them sidewise; others have long, hollow, jointed, sharp-pointed beaks, with which they suck juices from plants or animals.

All these kinds of insects that have six legs can be put into seven piles. Some wise men think there ought to

be as many as nineteen piles, or even more, and perhaps they are right. But the older they grow and the wiser they get to be the less willing they are to agree among themselves about the number of piles that ought to be made, and so, as we are neither very old nor very wise, and as seven is a handy number, we will make seven piles of all the kinds of insects that we catch, and in our next lesson we will try to find some things that will be true of all the insects in one pile, and will not be true of the insects in any other pile.

Through a printer's blunder, the beautiful story of Zekko and his family, entitled "Two Ears," was reprinted in NATURE STUDY without credit. No complaint has been received, but common fairness demands that we make such amends as possible by stating what was intended to be stated in the first place, that "Two Ears," written by Alva Deane, first appeared in the *Kindergarten Review* for February, 1892.

An interesting demonstration of the intelligence of the ant was made by a student in the biological department of the University of Pennsylvania. The young man constructed a roadway two feet in length of metal and divided it into two parallel paths, separated by high partitions. One of the paths he painted red and the other blue, and at their end, in plain view, he put a morsel of rich cake. Then he set an ant at the beginning of the roadway. The ant at once made for the cake over the red path, whereupon the student turned on a lamp under his mechanism and heated the path to an uncomfortable degree. The ant kept on and finally secured the cake, but on its return it must have told itself that it had had a mighty uncomfortable journey. Several hours later the student brought it out again, another morsel of cake being set at the end of the roadway. The ant thought a moment and then started for the cake over the blue path. It remembered that the red one had been hot. To prove still more conclusively that it remembered, the student next blocked up the blue path, whereupon the ant did without the cake rather than venture after it by the red one.—*Philadelphia Record.*

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